MAY 1956

Power Engineering

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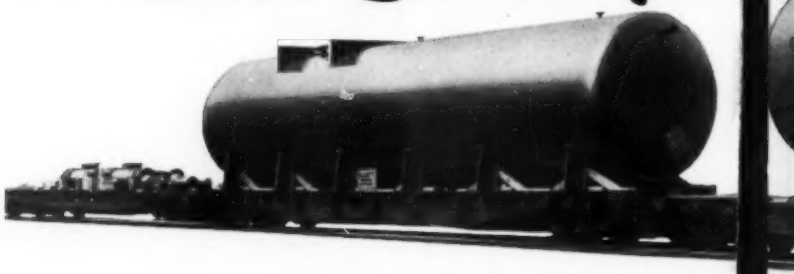
We don't kiss them goodbye



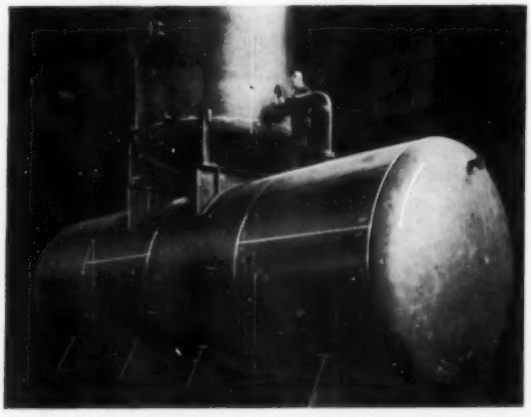
ELLIOTT DEAERATING HEATERS

You get a complete Elliott job
when you order an Elliott Deaerating Heater!

Elliott staff engineers do the design work, operating in a tradition set by forty years of Elliott deaeration progress and experience.

Construction starts on a large deaerating heater. All construction work is done in the large, well-equipped Elliott, Jeannette, Pa. plant.

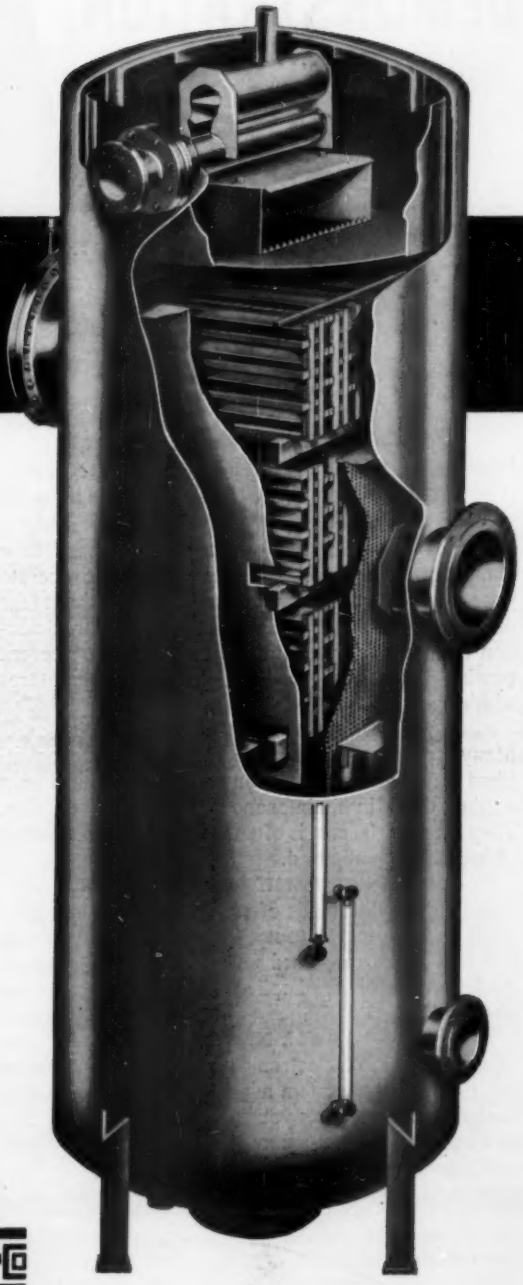
The Elliott welding shop where the "big ones" are built. Construction is in accordance with rigid ASME code requirements.

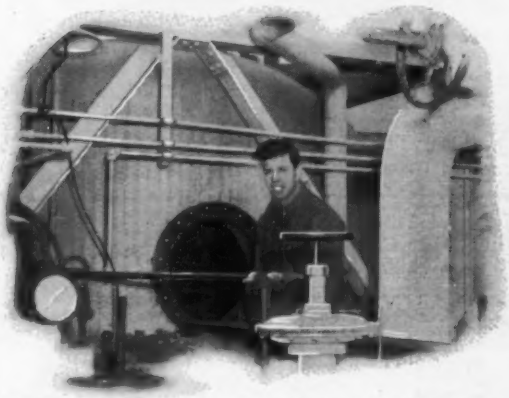


Elliott maintains complete facilities for hydrostatic testing. Every Elliott deaerating heater receives an "ok" here prior to shipment.

on the freight siding!

...are backed by field service attention throughout installation, start-up and operating life.

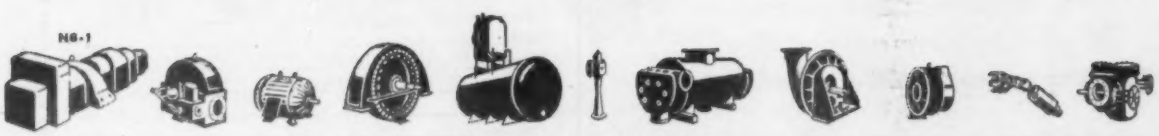




Elliott engineer inspects deaerating heater installation during periodic plant shutdown.

Elliott deaerating heaters are not only designed and fabricated in the Elliott Company headquarters plant, but are backed by Elliott factory-trained field engineers who are available for consultation on pre-installation questions, and for help on start-up and maintenance throughout the life of the equipment. For complete information on Elliott deaerating heaters, write Elliott Company, Jeannette, Pa.

ELLIOTT Company



TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

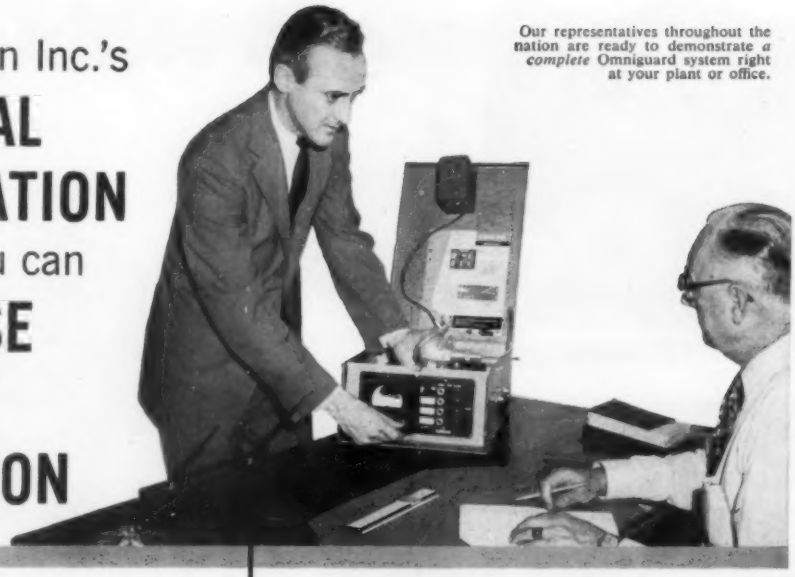
For more data circle 501 on Post Card

Thomas A. Edison Inc.'s

PERSONAL DEMONSTRATION

shows how you can

INCREASE PLANT PRODUCTION



Our representatives throughout the nation are ready to demonstrate *a complete* Omniguard system right at your plant or office.

Takes Only a Few Minutes to Prove Simple Omniguard System Protects Bearings and Processes; Cuts Down Time; Increases Equipment Life

Just take a few minutes to prove to yourself how Omniguard can make it possible for you to operate your equipment at peak production rates without fear of breakdowns . . . how this simple temperature detection system gives you ample opportunity to prevent bearing failures or to keep process temperatures within limits.

RECORDS REVEAL FAILURES COSTLY

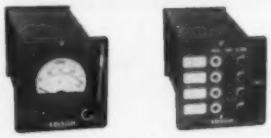
Many operators—after a record check—are astonished to find how much bearing breakdowns have been costing them in maintenance and lost production. They see that the cost is often many times the expense of installing Omniguard.

COMPLETE 4-POINT SYSTEM FOR LESS THAN $500

Consider the thousands of dollars involved in equipment and production output. Contrast this with the fact that one Omniguard unit costs less than $500. And because of its simplicity, installation costs are also low.

SIMPLE, DEPENDABLE

Omniguard has no electronic or moving parts. It is the most dependable system available today. Modular in design, each unit gives you four-point detection. You can add as many as you need . . . as you need them.



The modular indicator and monitor, with their mounting brackets, and the resistance temperature detectors, are all you need for a continuous operating analysis of remote process or bearing temperatures.

Resistance Temperature Detectors

These are just four of the many different types of temperature detectors produced for varied applications of the Omniguard system.

The 242P for high temperatures (to 1300°F.)

The 166NC with pre-loaded sensitive tip specially designed for bearing protection.

The 230N for general purpose industrial use (stem-sensitive).

The 235N90-35 for fast response in corrosive service.

A Partial List of Present Users

American Blower Corp.
City of Chicago
Combustion Engineering, Inc.
DeLaval Steam Turbine Co.
Eastman Kodak Co.
Esso Standard Oil Co.
Florida Power & Light Co.
General Electric Co.
Hercules Chemical Co., Inc.
I-T-E Circuit Breaker Co.
North American Aviation, Inc.
Public Service Electric & Gas Co.
Republic Steel Corporation
Sun Oil Company
Union Carbide & Carbon Corp.
Westinghouse Corp.

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NBP BPA

PUBLISHED SINCE 1896 FOR POWER ENGINEERS IN PRIVATE AND PUBLIC UTILITIES AND INDUSTRIAL PLANTS

ENGINEERS' PREVIEW

COMMONWEALTH EDISON has entered into an agreement for the acquisition of the electric transmission and distribution facilities of Produce Terminal Corp. of Chicago.

Produce Terminal for many years has served electricity to approximately 300 customers, chiefly industrial firms. The Terminal company generates part of the electricity it distributes, purchases the balance from Edison and supplies electricity in the Stock Yards area between Halsted St. and Western Ave. and in the Central Manufacturing District, including one area at the southwest corner of Kedzie Ave. and 47th St. and another lying between 47th St. and Pershing Road and east of the Belt Line Railroad.

Produce Terminal plans to expand the steam heating and the process steam business which it now operates.

PLANS FOR the construction of a major steam-electric generating plant in southwest Virginia by the Appalachian Electric Power Company have been announced.

The plant will be built on property of the Clinchfield Coal Corp. Clinchfield is setting aside 40,000,000 tons from its large reserves which would be dedicated to supply coal for the new plant over a 30-year period under its contract with Appalachian.

The power station will be known as the Clinch River Plant, will have an initial generating capacity of 450,000 kw, and will cost an estimated $55,000,000.

A LARGE STEAM-TURBINE generator unit for the New England Electric System has been ordered from General Electric Co.'s Large Steam Turbine-Generator Department located in Schenectady, N. Y.

The new turbine-generator unit will be housed in an expansion of the System's Salem Harbor station, Salem, Mass. It will be nearly twice as large as any unit now on the system and will have a generating capability of at least 125,000 kw. The turbine which will drive the generator will be a tandem-compound, triple-flow, reheat type. This newest unit is scheduled to be placed in service in 1958.

ONE OF the electrical industry's best known and most honored scientists, Dr. Joseph Slepian, associate director of the Westinghouse Research Laboratories, retired March 1 after 40 years of service with Westinghouse.

T. C. WILLIAMS, president of Stone & Webster Engineering Corp., has announced the election of Edward J. Ford, Harold J. Sykes and Edwin H. Krieg as vice presidents of the Corporation.

Mr. Krieg, recently transferred to the New York office, will continue his activities as a consulting engineer and will devote his attention to the Corporation's interests in the steam power and related fields.

DIFFICULT as it may be to believe today in this fantastic "Age of Electronics," nearly a half century ago, around 1910, Dr. Lee de Forest was arrested by a United States

---

COAL STORAGE MANUAL . . .
Reprints Available

REPRINT copies of POWER ENGINEERING 24-page Coal Storage Manual, which appeared first as a Special Feature in the March issue, are now available in limited quantities to interested readers.

Because the demand for these reprints exceeded expectations, an additional supply has been procured. Up to 2 copies will still be sent free of charge to any reader who requests them by addressing the Editor, 110 S. Dearborn St., Chicago 3, Ill.

Additional copies up to 12, $1.00 each; over 12, but less than 100, 20% discount; more than 100, write for prices.

---

marshall in California and charged with trying to raise funds to finance his revolutionary invention, the audion tube, which an ignorant district attorney labeled "a criminal fraud!" Before a grand jury, the same district attorney angrily thundered: "De Forest should be sent to the penitentiary for selling stock in this worthless piece of glass! Why, it does not give off as much light as a 25¢ bulb!" *{Source unidentified}*

AS A CONTRIBUTION to its continuing educational program, the Rigid Steel Conduit and EMT Section of NEMA recently completed a 20-minute sound color motion picture called Blueprint for Power. Designed for professional audiences, it demonstrates the many advantages derived from the use of rigid steel conduit and EMT in building and renovating programs. The theme is convincingly developed through the experience and understanding of down-to-earth characters, each having the know-how of his own particular field. Blueprint for Power may be borrowed, without cost, for showing to group gatherings. If interested, write on your own letterhead to: Rigid Steel Conduit and EMT Section of National Electrical Manufacturers Association, 155 East 44th St., New York 17, N. Y.

ONE OF THE NAVY'S newest minesweepers, *U. S. S. Cormorant,* has less metal in it per square foot than any other type of Navy ship. The 144-ft hull is built entirely of wood, but plastic pipe is used in many places where only metal pipe has qualified before; for example, to handle bilge, cold salt water for fire mains and cold fresh water. It is also used in the voice tubing.

Make-It-Yourself Transmission Line Calculator

Hundreds of readers have already requested the full-size cut-outs and instructions for making this calculator, as described on page 106, March 1956 issue.

However, we still have a supply of the cut-outs and if you want a set, write the Editor, POWER ENGINEERING or jot Transmission Line Calculator on one of the prepaid post cards elsewhere in this issue and mail it to us.

Courtesy, Coal to Kilowatts

"I for one am getting sick and tired of these Safety Sessions"

The same material, produced in sheet form, has been used on the *Cormorant* to construct Diesel oil collector tanks and water tanks, previously made of metal. Both the pipe and tanks have been tested under service conditions for more than one year aboard ship.

The pipe and fittings weigh only about one-quarter as much as standard steel pipe, but in many services, it is claimed, will outlast steel, copper, cast iron or stainless steel. The pipe in any size may be preheated and bent and joined to existing pipe systems by means of flanges.

If you want more information about this interesting material, write *Engineers' Preview* editor.

JAY SAMUEL HARTT, Chicago, was elected president of Middle West Service Company, effective January 1, 1956. He succeeds Edwin Vennard, who is resigning the presidency to become managing director of Edison Electric Institute, New York. Mr. Vennard will continue as a member of the Middle West executive committee and board of directors until March 1, when he joins EEI. Mr. Hartt previously headed his own firm of consulting engineers which merged with Middle West Service Company on December 31, 1954. Mr. Hartt has been chairman of the executive committee since the merger.

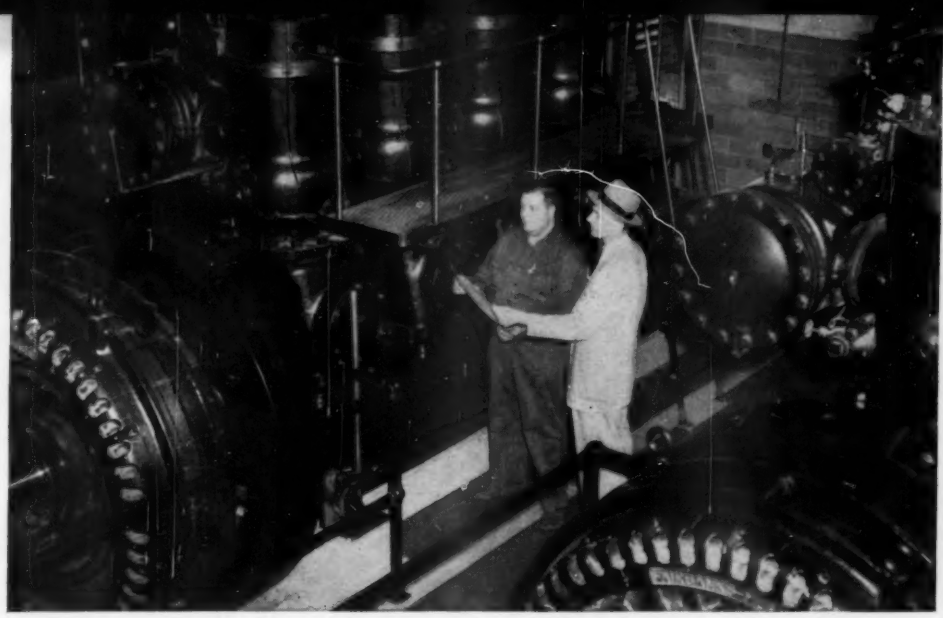
DID POWER ENGINEERING get scooped or did the U. S. Navy get scooped or did Hugh Swofford & Associates get scooped? We can't quite figure it out. However, here's the story: In *Engineers' Preview,* December 1955, page 3, we published an item stating that *Navy Technical News,* formerly published by the office of the Chief of Information Department of the Navy, is now being published privately by Hugh Swofford & Associates, Inc. Now we learn that the Navy Office of Information has resumed publication of the *Navy Technical News,* which is the official organ of the Navy Office of Information and is free.

The *Navy Technical News* terminated publication almost a year ago, but because of the needs and requests of the original subscribers resumed printing about December 1, 1955. For further information about it, get in touch with Murray T. Smith, Lieut.(jg), USN, Editor, *Navy Technical News,* Office of Information, Department of the Navy, Washington 25, D. C.

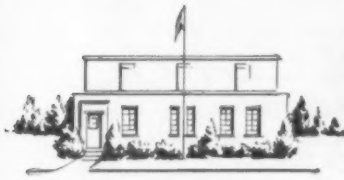
M. S. UMBENHAUER has been appointed manager of power plant design for The Fluor Corp., Ltd. In this newly-created Fluor post, Umbenhauer will direct the company's technical services to the electric power industry.

Power projects completed under his direction during the past total more than 600,000 kilowatts. Before joining Fluor, he was sales engineer for Energy Control Co., Inc., New York, and chief mechanical engineer for Burns and Roe, Inc., New York. Other posts include general manager and chief engineer of Armstrong Engineering Co., New York; power and maintenance superintendent, Lion Chemical Corp., and an incremental studies engineer AG & E Co.

RAYMOND STEVENS was elected president of Arthur D. Little, Inc., Cambridge, Mass., industrial research company, at the annual stockholders meeting; he has been a vice president of the company since 1930. Mr. Stevens has directed the expansion of the company's scientific activities into various pioneering fields such as operations research. In May the American Institute of Chemists will present its Gold Medal to him for his contribution to the "wider understanding of the essential procedures for the management and operation of industrial research." He will succeed Dr. Earl P. Stevenson, who is now ADL board chairman.



Melvin Nissen (left) plant superintendent Graettinger, Iowa, and Standard Oil lubrication specialist R. R. Spargo inspect maintenance records. Assisting customers with lubrication problems is something for which Bob Spargo is well qualified. He is a mechanical engineer with a degree from Iowa State College and a graduate of the Standard Oil Sales Engineering School. Bob has been providing lubrication technical assistance to Standard customers for nearly nine years. Customers find his experience and training pay off for them.



How STANDARD D&G Oil helped lick five problems in one plant

Excessive deposits, excessive maintenance, high oil consumption, were among problems solved by change-over to STANDARD D&G Oil at Graettinger, Iowa, Municipal Light Plant

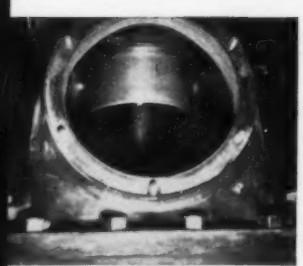
Three years ago the Graettinger Municipal Light Plant began using STANDARD D&G Oil. Prior to this change-over, good engine performance was hampered by:

1. **Excessive carbon deposits**
2. **Excessive port carbon**
3. **Stack fires**
4. **Ring sticking**
5. **High oil consumption**

The plant averages 4.3 million HP hours of operation annually. Before changing to STANDARD D&G Oil, ports had to be cleaned several times a year. Now, with STANDARD D&G Oil in the engines, ports aren't touched between annual overhauls. Ring sticking and piston and cylinder deposits are virtually eliminated. All of this has been accomplished while continuing the use of low cetane, low gravity fuel.

Good management, careful maintenance and STANDARD D&G Oil have teamed to deliver this performance at Graettinger. Maybe you would like to use STANDARD D&G Oil to obtain similar performance from your engines. A Standard Oil lubrication specialist is nearby in any of the 15 Midwest and Rocky Mountain states ready to show you. Call him. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

Standard man Bob Spargo (left) and plant superintendent Melvin Nissen inspect piston through crankcase inspection plate hole. With STANDARD D&G Oil, light plant has cut oil consumption in half.



Piston of one of F-M engines at Graettinger Light Plant. STANDARD D&G Oil has kept maintenance down, cut piston and liner wear.

Quick facts about **STANDARD D&G OIL**	
1	Made from highest-quality solvent-refined stock.
2	Contains additives which impart superior detergent-dispersant and anti-corrosion properties.
3	Anti-foaming.
4	Oxidation resistant.
5	Recommended for use (1) with economy fuels, (2) in extreme-load and/or low temperature service.

STANDARD

STANDARD OIL COMPANY
(Indiana)

For more data circle 503 on Post Card

WHAT THEY TELL US

WHAT SHOULD HE DO with these water tanks?

We have two insulated 5 ft by 15 ft hot water tanks in our plant. During the past year, I have found we have an ample supply of hot water to fulfill our needs. Therefore, I have isolated one tank.

After inspecting the tanks, I found that both tanks have considerable scale and are deteriorating rapidly. I have had several quotations to sandblast and reline the tanks. One to use permalene porcelain ½ in. thick, the other elastic porcelain ¼ in. thick. Both carry a 5-year guarantee. In your opinion, which will give the most satisfactory service?

Would it be advisable to reline both tanks or to have the one tank we plan to put in storage sandblasted and insert magnesium rods? If so, how many pounds of magnesium would be required to safely preserve the tank for a period of 5 years?

For operating cost and budget control, is it possible to utilize our steam condensate return line, to either heat the water or use one tank as a tempering tank to reduce the use of steam?

Our steam is purchased from a central source and is based on pounds per hour incoming flow. No variable factor is applied for condensate temperature return. — *W. W. B., Baltimore, Md.*

Some of these questions require study by a consulting engineer. It is possible to indicate, however, the general procedure to follow for specific answers to them. Comments from readers are invited. Write POWER ENGINEERING, *What They Tell Us*, 110 S. Dearborn St., Chicago, Ill.

ZIMMERMAN PROCESS may offer solution

In the December 1955 issue of POWER ENGINEERING, you published an article entitled Organic Waste Burns Wet — Produces 2200-psi Steam. This article is of great interest to a group of engineers here in San Diego, since it may offer a solution to our twin problems of bay contamination by sewage and the possibility of reclaiming water in a water-short country. At present these problems are under study and immediate steps must be taken to reach a solution.

If any added information or physical data on the Zimmerman process is available, it will be greatly appreciated. The information that the process might be adaptable to our need makes us anxious to explore the possibilities to the fullest extent.

At this same time, may I say that I enjoy your magazine a great deal and I believe it makes a worthwhile addition to any engineer's library. — *C. C. M., San Diego, Calif.*

Further information is available to interested companies. Write to *What They Tell Us* and we'll tell you how to get it.

WE NOW HAVE AN ACCESS PERMIT

On March 5 the United States Atomic Energy Commission granted Access Permit No. 806 to Technical Publishing Company.

In order to make classified atomic energy information available to organizations and individuals for their private uses, the Atomic Energy Commission started the Access Permit program on April 20, 1955. Under this program, private individuals or organizations may obtain permits for access to either Confidential or Confidential and Secret Data, depending on their needs. Such an Access Permit provides security clearance for such an organization's personnel as will require access but each individual must fulfill the requirements set up under this new program. After fulfilling these requirements permit holders and their employees may receive classified matter and discuss classified topics with other cleared people.

"Just give it a kick — sometimes that'll do it."

Access Permit holders are also eligible to attend the periodic Access Permit meetings which are held at various AEC sites for the purpose of disseminating technological information of interest to companies planning atomic energy activities.

The Access Permit program is part of the broad AEC program to foster the development of private atomic energy industry. As an Access Permit holder, Technical Publishing Company will enable its editors to acquire a more thorough and effective background against which to evaluate nuclear power developments. The Access Permit provision was enacted as part of the Atomic Energy Act of 1954, largely to help small and medium-sized industries in getting into the nuclear energy field. Its intent is not only to make available certain categories of restricted data but also to direct attention to the large amount of unclassified information that is already available for use by industry.

ADDRESSED TO Associate Editor R. C. Hagenmiller

Thanks very much for the two copies of your Coal Storage Manual reprint. The subject, of course, is one near and dear to my heart. You are to be complimented on your excellent presentation — *William Bradbury, Editor of Utilization, The Magazine of Coal Uses.*

TURBINE OVERHAUL SERIES highly valued

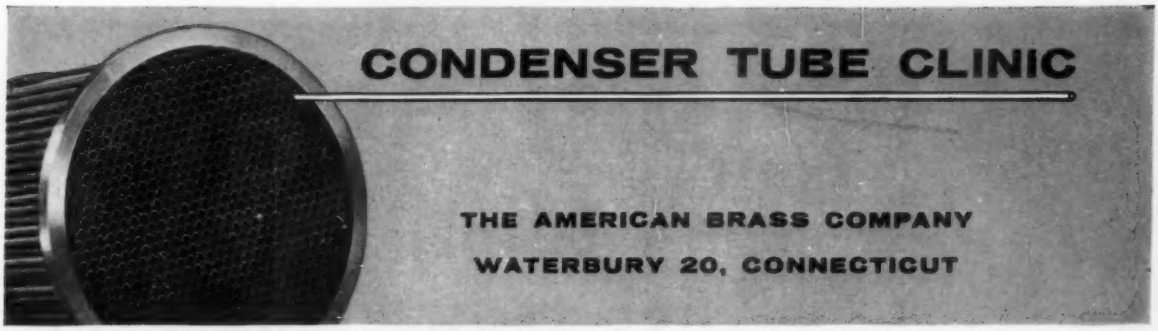
Your March issue was very opportune because of the article, Adjusting Bearing Pads During Turbine Overhaul.

We were in the process of doing an outage inspection on a turbine generating unit when the following question came up: *What happens to a top or bottom shim pad after a bearing is moved off the vertical center-line of the casing bore?* I remembered your article and brought it into the job where it was read with great interest.

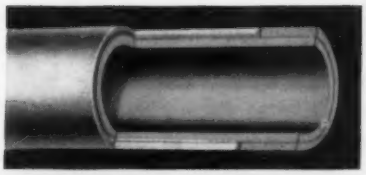
Needless to say it settled a debate that was going on regarding this move.

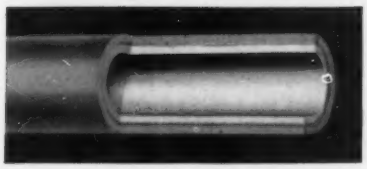
I also found that POWER ENGINEERING magazine itself was of interest to our maintenance personnel. Two of the men have expressed a desire to subscribe to your magazine and are also interested in obtaining the complete Turbine Overhaul inspection series — *Harold L. Willard, Marblehead, Mass.*

The above series, So You're Going to Overhaul Your Turbine Generator, by Associate Editor N. S. Jones, made its first appearance in April 1955. It will be concluded in August. We now have hundreds of requests for reprints of this series.



How two-tubes-in-one can help you solve complex corrosion problems





ANACONDA Duplex Heat Exchanger Tubes are for two types of service—where the corroding characteristics of fluids inside and outside the tube are best met with different metals or alloys—where internal or external pressures, or the pressure-temperature combinations, are too great for a nonferrous tube alone. In the latter case, an Anaconda copper alloy with the required corrosion resistance is placed outside or inside a steel tube—and the pair is drawn together. The finished Duplex Tube has the chemical properties required for the more corrosive fluid handled—plus the needed strength.

Edited by James T. Kemp, Metallurgical Engineer

TWO SEPARATE CORROSION PROBLEMS. A Duplex Tube of steel with copper or a copper alloy inside is used, for example, in exchangers or condensers handling water in the tubes and ammonia or a fluid with appreciable amounts of ammonia in the shell. Moist ammonia attacks copper and all of its alloys, and may cause stress-corrosion cracking. Stresses may be due to applied loads or may be residual from cold working of the metal. Steel, however, is not susceptible to such action by ammonia. Thus the nonferrous tube is shielded and can perform its normal function of giving long service life and efficient heat transfer on the "water side."

Other combinations of coolant—or heating fluid—and "stream" are found in petroleum refineries and chemical plants, in which differing properties are required inside and outside an exchanger tube. Here two nonferrous metals may be combined—a Cupro Nickel and Admiralty, for example.

HEAT TRANSFER. Duplex Tubes have thermal transfer characteristics somewhere between those of the two metals used. Each face of the tube has the receptivity-emissivity of its metal. The metal-to-metal interface is so intimate it offers little resistance to heat flow.

FERRULES. Duplex Tubes can be supplied with ferrules of the same composition as the inner tube (see upper illustration), replacing a short section cut from the end of the outer tube. This ferrule prevents excess corrosion of the ends exposed in the exchanger channel. The ferrule should be long enough to be securely rolled in when the Duplex Tube is expanded into the tube sheet.

TECHNICAL ASSISTANCE. The American Brass Company's metallurgical engineers and its sales representatives throughout the country are available to help you in the selection of the Anaconda Condenser Tubes to meet your problems. Write: Technical Department, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 8678

ANACONDA®
Tubes and Plates for Condensers and Heat Exchangers

PHYSICAL PROPERTIES OF ANACONDA CONDENSER TUBES*

ALLOY	Tensile Strength, psi	Yield Strength at .5% Elongation Under Load, psi	Elongation in 2", %	Rockwell Hardness, B Scale	Density, Lb. per Cu. in.	Thermal Conductivity, B.T.U./Sq. Ft./ In./Hr./°F. at 68° F.	Average Coefficient of Linear Thermal Expansion per °F. (77-572 F.)
Arsenical Admiralty-439	52,000	22,000	60	6-45	0.308	768	.0000112
Ambraloy-927	60,000	27,000	55	35-65	0.301	696	.0000108
Ambraloy-901	60,000	30,000	60	30-60	0.295	552	.0000099
Cupro Nickel, 30%-702	55,000	22,000	50	30-60	0.323	204	.0000090
Cupro-Nickel, 10%-755							
Light Annealed	44,000	22,000	46	25	0.323	314	.0000093
Light Drawn	60,000	57,000	15	68			
Red Brass-24	42,000	15,000	50	0-30	0.316	1104	.0000104
Ambronze-421	46,000	20,000	55	0-30	0.316	830	.0000102
Phosphorized Arsenical Copper-108							
Light Drawn	40,000	35,000	20	20-50	0.323	1344	.0000098
Hard Drawn	54,000	50,000	8	50-70			
Phosphorized Copper-103							
Light Drawn	40,000	35,000	20	20-50	0.323	2364	.0000098
Hard Drawn	54,000	50,000	8	50-70			

*Note: The above values are approximate and should not be used for specification purposes. *Light annealed except as noted.*

For more data circle 504 on Post Card

going places?

DON'T BOTHER TO UNPACK..
USE YARWAY GUN-PAKT

● Progressive steam plants, geared to fast production, use Yarway Gun-Pakt slip-type expansion joints because they can be repacked under full pressure right on the job.

No service interruptions, no shutdowns, no loss of man and machine hours. While the line is *under full steam pressure*, packing is added as needed and the joints lubricated. That's all the maintenance required.

Compare this to the maintenance of conventional gland-packed joints. Consider the labor involved. Consider also the profit loss during shutdowns. It all adds up to GUN-PAKT.

Leading institutions, industrial plants and central station heating plants are standardizing on Yarway Gun-Pakt Expansion Joints. Investigate Yarway Expansion Joints yourself. Write for Yarway Bulletin EJ-1913.

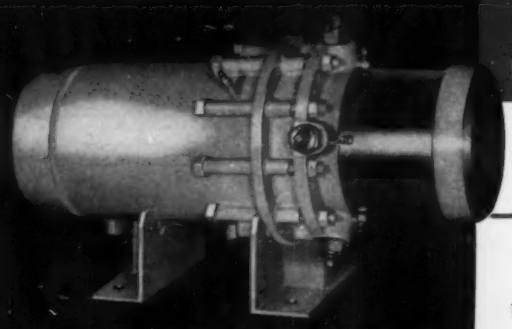
YARNALL-WARING COMPANY
100 Mermaid Avenue
Philadelphia 18, Pa.

BRANCH OFFICES
IN PRINCIPAL CITIES

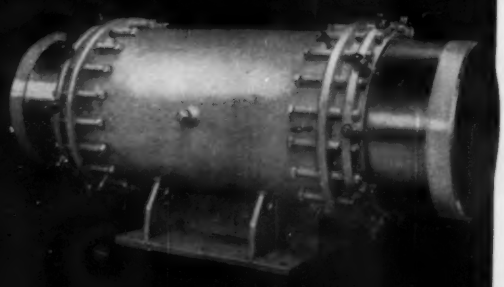
● To add packing to a Yarway Gun-Pakt Expansion Joint, just insert Yarway Plastic Packing, twist a wrench and the joint is tight . . . the job done. *There is no unpacking operation.*

YARWAY gun-pakt

EXPANSION JOINTS



Single end, welding-type Yarway Gun-Pakt Expansion Joint with base for pressures to 300 psi. 12 inch traverse.



Double end, welding type Yarway Gun-Pakt Expansion Joint with base for pressures to 300 psi. 24 inch traverse.

compare these maintenance records

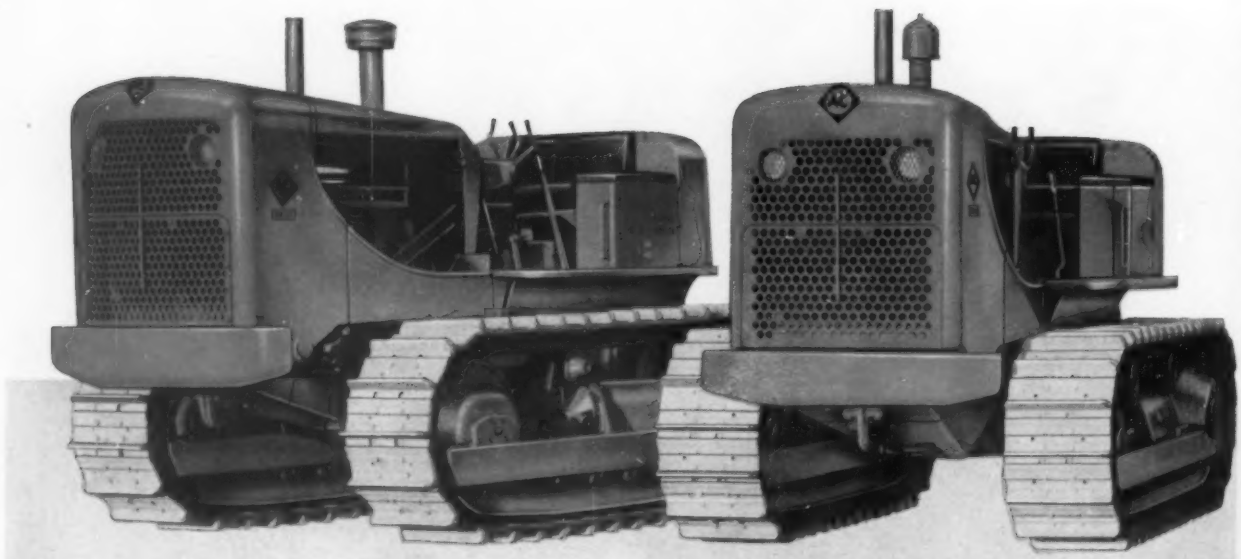
	YARWAY GUN-PAKT JOINTS	CONVENTIONAL GLAND-PACKED JOINTS
STATE UNIVERSITY*	Required addition of only 3 slugs (45 cents) of packing in 5 years. Lubrication only once every 6 months. Total labor time of only 2 manhours in 5 years.	Same lubrication as Gun-Pakt, *plus* gland tightening, *plus* complete overhaul with shutdown for unpacking and repacking every 3 to 4 years. Time for overhaul—25 manhours per joint!
MID-WEST AIRFIELD*	Only maintenance was lubrication and addition of 2 slugs (30 cents) of packing per year. Total labor ¾ manhour per joint per year.	Lubrication and gland tightening required 8 manhours per joint per year—plus complete unpacking and overhaul every 2 to 3 years. Time required for overhaul—20 manhours per joint.
"BIG TEN" UNIVERSITY*	Lubrication only once every 2 months, with packing added as needed. Total labor time charged, 1 manhour per joint per year.	General maintenance requires 6 manhours per joint per year. Complete overhaul required every 2 to 3 years with unpacking and repacking—24 manhours per joint.

expansion joints

OTHER YARWAY PRODUCTS

BLOW-OFF VALVES
WATER COLUMNS AND GAGES
LIQUID LEVEL INDICATORS
IMPULSE STEAM TRAPS
FINE SCREEN STRAINERS
SPRAY NOZZLES
DIGESTER VALVES
HYDRAULIC VALVES

For more data circle 505 on Post Card



ALLIS-CHALMERS HD-21 TORQUE CONVERTER DRIVE

Hp — 204 net engine
Weight — 44,000 lb
Drawbar pull — up to 65,000 lb

ALLIS-CHALMERS HD-16

Standard Transmission	Torque Converter Drive
Hp — 141 belt	Hp — 150 net engine
Weight — 31,500 lb	Weight — 31,600 lb
Drawbar pull — up to 37,700 lb	Drawbar pull — up to 60,000 lb

More features you want for coal-handling ability... long life...low operating costs

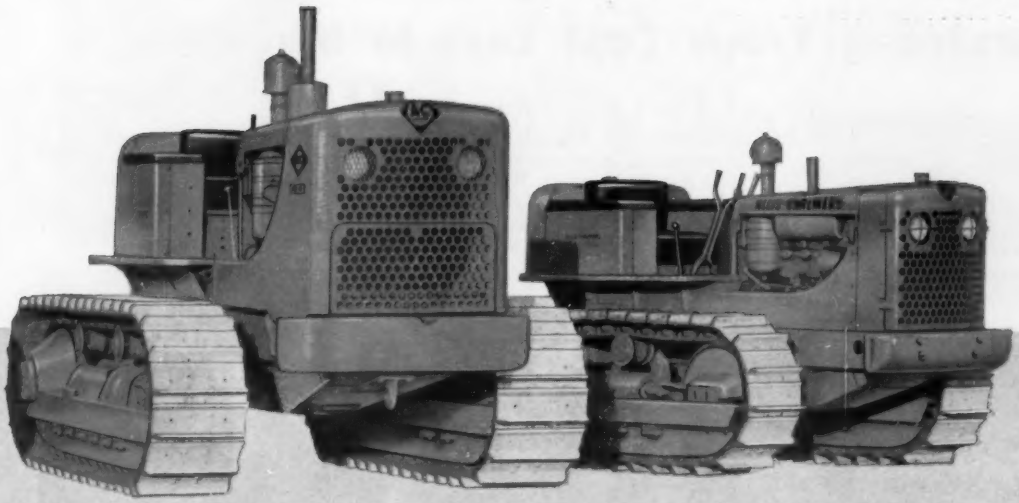
HERE IT IS . . . the all-new Allis-Chalmers line of crawler tractors . . . with more of everything you've wanted most — more work power, more long-life features, more easy maintenance and easy operation features, more versatility.

You get all the benefits of Allis-Chalmers advanced basic design with the new Allis-Chalmers diesel engine . . . proved torque converter drive for the HD-21 and HD-16 . . . all-steel, box-A main frame . . . unit construction . . . 1,000-hour lubrication intervals for truck wheels, idlers, support rollers . . . double-reduction final drives, and many other features.

There's a complete line of tractor equipment, too, including scrapers, hydraulic and cable dozers — and a full line of tractor shovels, with bucket capacities up to 7 yd (5 ton of coal).

Behind this equipment are dealers with sales and service personnel and facilities that assure you expert "after sales" care. The True Original Parts they stock help give you continued top performance and long equipment life.

Let your Allis-Chalmers dealer show you how these feature-packed crawlers can do *your* coal handling better and at lower cost.



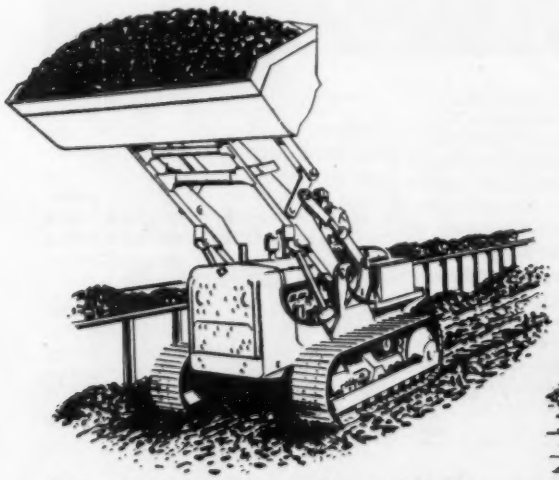
ALLIS-CHALMERS
HD-11

Hp — 85 belt
Weight — 20,500 lb
Drawbar pull — up to 21,980 lb

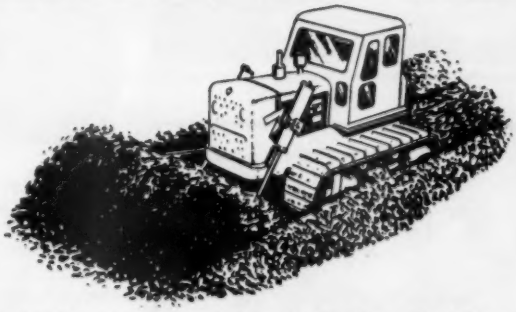
ALLIS-CHALMERS
HD-6

Hp — 55 belt
Weight — 12,400 lb
Drawbar pull — up to 12,650 lb

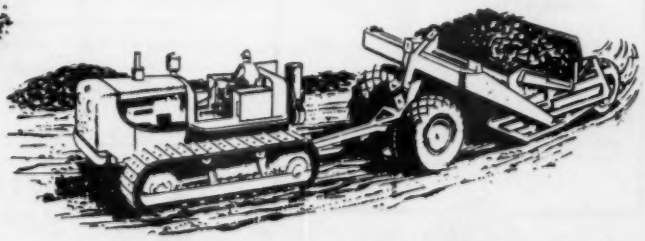
MATCHED EQUIPMENT TO FIT YOUR NEEDS



Four models of tractor shovels are offered with bucket sizes that will handle up to 5 tons of coal.



You have a wide choice of dozer blades for each of the four sizes of crawler tractors.



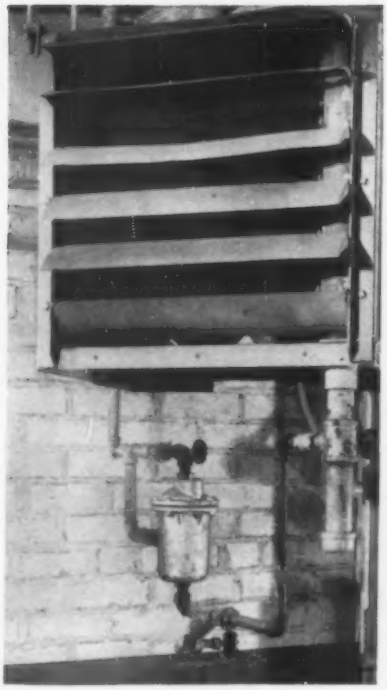
There are efficient coal-hauling scrapers in a range of sizes for use with Allis-Chalmers crawler tractors.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

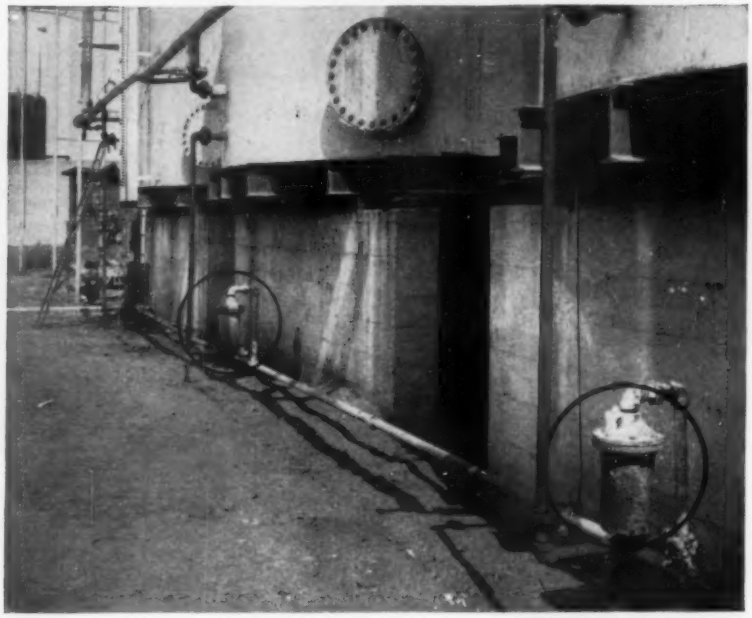
For more data circle 506 on Post Card

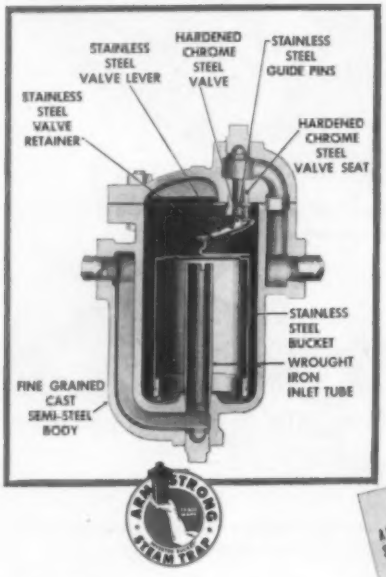
Major Chemical Company Reports Armstrong Traps Cost Less to Maintain



INDOORS—Mr. George Gentes, Works Manager at Hooker Electrochemical Co., Tacoma, Wash., says, "We feel that we get excellent service with Armstrong traps. We have been using them for about 10 years."

OUTDOORS—these Armstrong traps give year 'round service at Hooker's big Tacoma plant.




STAINLESS STEEL VALVE LEVER
HARDENED CHROME STEEL VALVE
STAINLESS STEEL GUIDE PINS
STAINLESS STEEL VALVE RETAINER
HARDENED CHROME STEEL VALVE SEAT
STAINLESS STEEL BUCKET
WROUGHT IRON INLET TUBE
FINE GRAINED CAST SEMI-STEEL BODY
ARMSTRONG STEAM TRAP

Simple, dependable Armstrong traps mechanisms have only two moving parts—bucket and lever. Design, materials and workmanship in low and medium pressure traps identical to that of traps for 900 lbs., 900°F service!

Trap's Lot is a Hard One. A steam trap takes a lot of punishment. On some jobs it may operate *1,000,000 times a year*. The parts are subjected to dirt, scale and corrosive substances, high temperatures and the erosive action of the condensate.

Armstrong's Take it Well. Armstrong traps endure these conditions remarkably well. In reporting on less trap maintenance since installing Armstrong traps Mr. George Gentes, Works Manager of Hooker Electrochemical Company's plant at Tacoma, Washington stated:

"We get excellent service . . . our trap maintenance cost is very low."

Others Agree. More Armstrong customers mention low maintenance than any other single benefit. That means more than low repair costs. It means freedom from leaky traps that waste steam, freedom from faulty traps that slow up production—freedom from *trouble*.

A Suggestion. Send for the Armstrong Catalog listed below or, better yet, call your local Armstrong Representative or Distributor—he's exceptionally well qualified to help you improve your trapping situation.

ARMSTRONG MACHINE WORKS
810 Maple Street • Three Rivers, Michigan

FREE
44-PAGE STEAM TRAP BOOK—Send for yours—no obligation.

ARMSTRONG MACHINE WORKS
810 Maple Street, Three Rivers, Michigan
Please send Steam Trap Book to:

Name_____
Company_____
Address_____
City_____ Zone___ State_____

For more data circle 507 on Post Card

For the Maximum in Fly Ash Recovery...

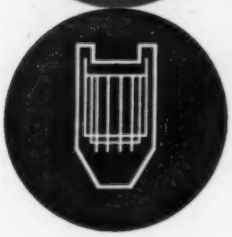
... an unbiased recommendation from

WESTERN PRECIPITATION

The only organization with 48 years of dust collection experience.

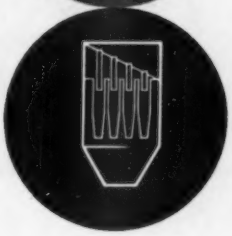
ELECTRICAL, MECHANICAL and CMP types of recovery systems.

COTTRELL *Electrical* PRECIPITATORS



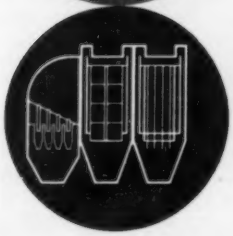
Western Precipitation pioneered commercial application of the now-famous Cottrell **Electrical** Precipitator—has more know-how, more experience, more basic advancements in this highly-technical electrostatic field of recovery than any other organization, domestic or foreign.

MULTICLONE *Mechanical* COLLECTORS



Western Precipitation pioneered the multiple small tube type of cyclonic collector—the type with higher centrifugal forces for greater recovery efficiencies. Multiclones are also easier to install, service and maintain—and require less space than other equipment of comparable capacity.

CMP *Combination* SYSTEMS!



Western Precipitation pioneered the CMP (Combination Multiclone-Precipitator) type of recovery unit now favored by so many leading power plant operators—the unit that combines advantages of both the Mechanical and Electrical principles, and provides almost constant collection efficiency despite varying gas volume.

Plus **invaluable know-how**

The most important part of **every** Western Precipitation installation is this organization's unequalled experience gained through almost a half-century of continuous leadership in the highly-complex science of recovering suspensions from industrial gases. No other organization—anywhere—offers such seasoned judgment in Electrical, Mechanical and CMP recovery methods. Yet you pay nothing extra for this invaluable "know-how"!

Let us send you literature which describes Western Precipitation's unique services in greater detail. Write, wire or phone our office nearest you!

WP

COTTRELL Electrical Precipitators
MULTICLONE Mechanical Collectors
CMP Combination Units
DUALAIRE Reverse-Jet Filters
HOLO-FLITE Processors

Western Precipitation Corporation

Designers and Manufacturers of Equipment for Collection of Suspended Materials from Gases and Liquids

Main Offices: **1029 WEST NINTH STREET, LOS ANGELES 15, CALIFORNIA**

Chrysler Bldg., New York 17 • 1 North La Salle Street Bldg., Chicago 2 • Oliver Bldg., Pittsburgh 22 • 3252 Peachtree Rd. N. E., Atlanta 5 • Hobart Bldg., San Francisco 4 • Precipitation Co. of Canada Ltd., Dominion Sq. Bldg., Montreal

For more data circle 508 on Post Card

It's in the Bag!

Fresh, Clean Ink for a Year of Trouble-free Recording

★ You won't have any messy, time-consuming re-inking of pens on the new Bailey Recorders. The entire system is white-glove clean—hermetically sealed, non-evaporating, non-corrosive. Gone is any chance of sludge or oxide formation. Gone are clogged pens, interrupted records, unsightly splashes.

The transparent plastic ink sacs are changed once a year—that's all. Capillary tubing carries fresh, clean ink to the pens continuously without any day-to-day attention.

This exclusive new inking system* is only one of the many time-saving, money-saving distinctive features of the new Bailey Recorder.

Ask for Product Specification E12-5.

*Now available for the New Bailey Recorder only.

ONLY BAILEY OFFERS ALL THESE ADVANTAGES IN A SINGLE RECORDER

- Pre-calibrated plug-in receiver units
- Up to four pneumatic or electronic receivers —or two receivers and two integrators
- Any four variables on one chart—easily read and interpreted
- A full year's ink supply at one loading
- Faster ordering—from stock
- Minimum inventory of parts
- Minimum instrument investment for process cycle expansion or alteration

BAILEY METER COMPANY
1040 IVANHOE ROAD
CLEVELAND 10, OHIO
Controls for Power and Process

Controls for
TEMPERATURE
PRESSURE
GAS ANALYSIS
FLOW · LEVEL
RATIO · DENSITY

For more data circle 509 on Post Card

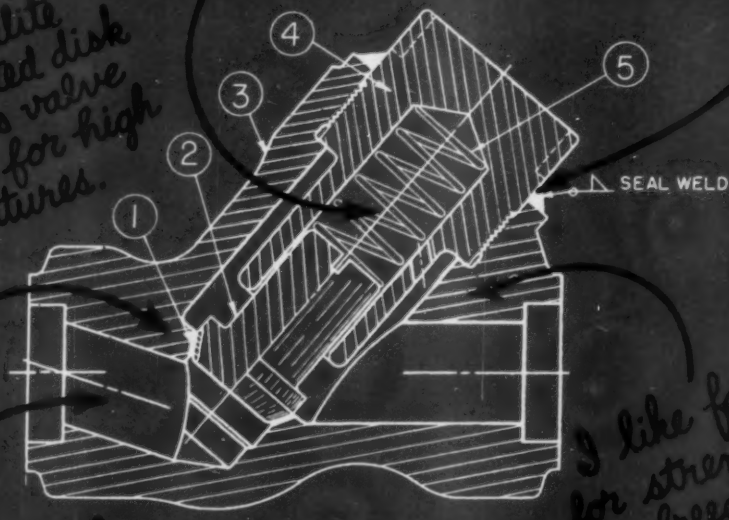
J. B.—
Here is the check valve companion to the Edward Unisalve.
R. Y. P.

Proven seal-welded joint. Permanently tight yet readily disassembled.

ROCKWELL BUILT
Edward Valves

Edward has used this disk-guide-spring design in small checks for many years. Gives excellent alignment and is dependable.

Integral Stellite seat, Stellited disk make this valve suitable for high temperatures.



Straight-through flow is important. Prevents erosion—keeps seating surfaces clean.

Ask Edward to quote—including these checks.

I like forgings for strength and freedom from porosity. This valve is all forged.

By the way, Edward builds these in 1500 and 2500 pressure classes.

LIST OF MATERIAL
QUANTITIES ARE FOR ONE GLOBE OR ONE ANGLE VALVE
WHERE A.S.T.M. SPECIFICATIONS ARE INDICATED THE LATEST REVISION APPLIES

PIECE NO.	NAME OF PIECE	NO. REQ'D.	MATERIAL	SPECIFICATIONS	EDW. MS NO.
1	SEAT	1	INTEGRAL WITH BODY	STELLITED	483
2	DISK	1	FORGED ALLOY STEEL WITH STELLITED SEATING FACE	A.S.T.M. A182 GRADE F11	227 481
3	BODY	1	F. ALLOY STEEL	A.S.T.M. A182 GRADE F11 (a)	227
			F. ALLOY STEEL	A.S.T.M. A182 GRADE F22 (b)	230
4	BONNET	1	F. ALLOY STEEL	A.S.T.M. A182 GRADE F11 (a)	227
			F. ALLOY STEEL	A.S.T.M. A182 GRADE F22 (b)	230
5	SPRING	1	STAINLESS STL.	A.S.T.M. TYPE 302	253

EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

LIFT TYPE CHECK VALVE
GENERAL ASSEMBLY
FIG.-2278 SIZES ½, ¾, 1, 1¼, 1½, 2

DRAWN: W. Ford
CHK'D: O. Gist
APP'D: [illegible] DATE: [illegible]
DRAWING NO. BE-3575-2

Edward builds Globe and Angle Stop, Non-Return, Stop-Check, Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

"Look Into" the latest complete data on

FUSES

FOR EVERY PURPOSE

To help you solve confusing fuse problems, Economy Fuse & Mfg. Co. has just issued a convenient, pocket-size folder that tells you exactly the right fuse for practically any purpose. This handy folder illustrates and describes all the latest fuse developments and lists capacities, sizes, prices, etc. Electrical contractors, and commercial, industrial or domestic fuse users, can obtain copies from their electrical dealer or wholesaler. "For Fuse Economy Use Economy Fuses."

Get your free copy of this new folder

All Trademarks Reg.

ECONOMY fuses for every purpose

SOLD THROUGH ELECTRICAL WHOLESALERS SINCE 1911

ECONOMY FUSE & MFG. CO.

2717 Greenview Ave. • Chicago 14, Illinois

Your Electrical Wholesaler has these ECONOMY FUSES in Stock

12251P

For more data circle 511 on Post Card

J.B.—
These "Special" features are standard on 1500 and 2500 lb Edward Univalves.
R.S.P.

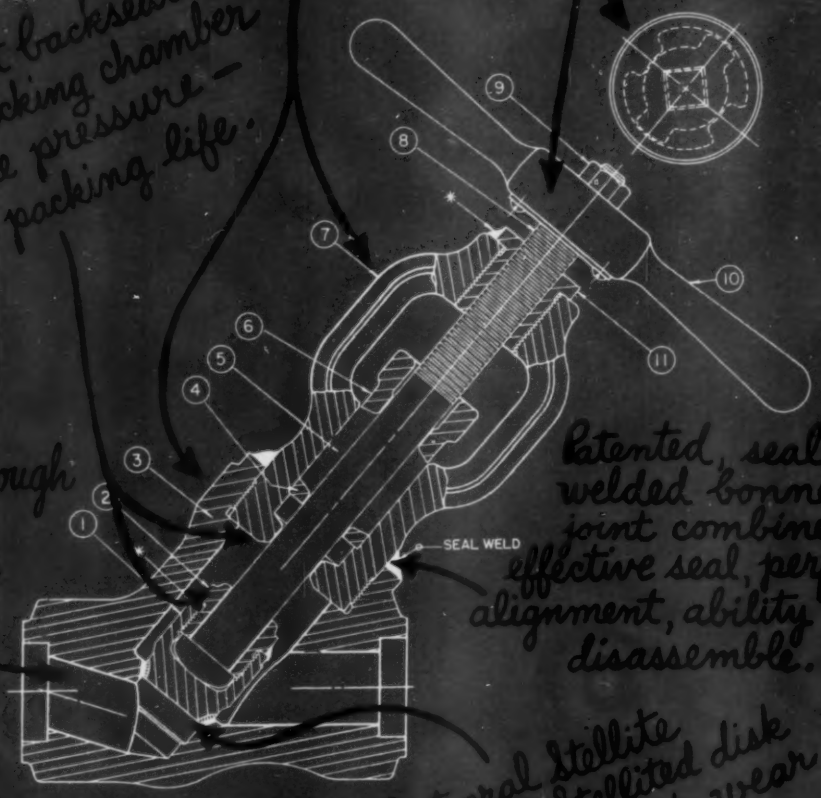
Impactor handle provides tight, effortless closing. No need for cheater.

Let's have Edward quote. Quality and performance are important.

All forged construction—No porous castings here.

ROCKWELL BUILT
Edward Valves

Line contact backseat isolates packing chamber from line pressure—prolongs packing life.



Straight-through design minimizes erosive wear due to turbulent flow—extends life.

Patented, seal-welded bonnet joint combines effective seal, perfect alignment, ability to disassemble.

Integral Stellite seat—Stellited disk resist wear.

LIST OF MATERIAL
QUANTITIES ARE FOR ONE GLOBE OR ONE ANGLE VALVE
WHERE A.S.T.M. SPECIFICATIONS ARE INDICATED THE LATEST REVISION APPLIES

PIECE NO.	NAME OF PIECE	NO. REQ'D.	MATERIAL	SPECIFICATIONS	EDWARD MS NO.
1	DISK	1	FORGED STEEL	A.S.T.M. A182 GRADE F11	227
2	DISK NUT	1	EVALLOY	A.S.T.M. A182 GRADE F6	212
3	BODY	1	FORGED ALLOY STEEL	A.S.T.M. A182 GRADE F11 (b)	227
				A.S.T.M. A182 GRADE F22 (b)	230
4	JUNK RING	1	STEEL-EVALIZED	A.I.S.I. C1020	123
5	PACKING RINGS		EVALPAK	HIGH TEMPERATURE PACKING	501
6	GLAND	1	FORGED STEEL	A.S.T.M. A105 GRADE II	111
7	BONNET	1	FORGED ALLOY STEEL	A.S.T.M. A182 GRADE F11 (b)	227
				A.S.T.M. A182 GRADE F22 (c)	230
8	STEM	1	EVALLOY	A.I.S.I. GRADE 416	261
9	STEM NUT	1	STEEL	A.S.T.M. A194 CLASS 1 OR 2	124
10	IMPACTOR HANDLE	1	MALLEABLE IRON	A.S.T.M. A47 GRADE 32510	322
11	YOKE BUSHING	1	BRONZE	A.S.T.M. B148 GRADE 9B HT	432
12	GLAND BOLT NUT	2	STEEL	A.S.T.M. A194 CLASS 1 OR 2	124
13	GLAND STUD	2	STEEL	A.S.T.M. A193 GRADE B7	208
14	GLAND BOLT LOCKNUTS	4	STEEL	A.S.T.M. A194 CLASS 1 OR 2	124

EDWARD VALVES, INC.
SUBSIDIARY OF ROCKWELL MANUFACTURING CO.
EAST CHICAGO, INDIANA

FORGED STEEL UNIVALVES
GENERAL ASSEMBLY
FIG.-3924 SIZES ½, ¾, 1, 1¼, 1½, 2

DRAWN: A. D. L.
CHK'D: J. Piet
APP'D: R. S. Peterson
DATE: 1-1-[illegible]

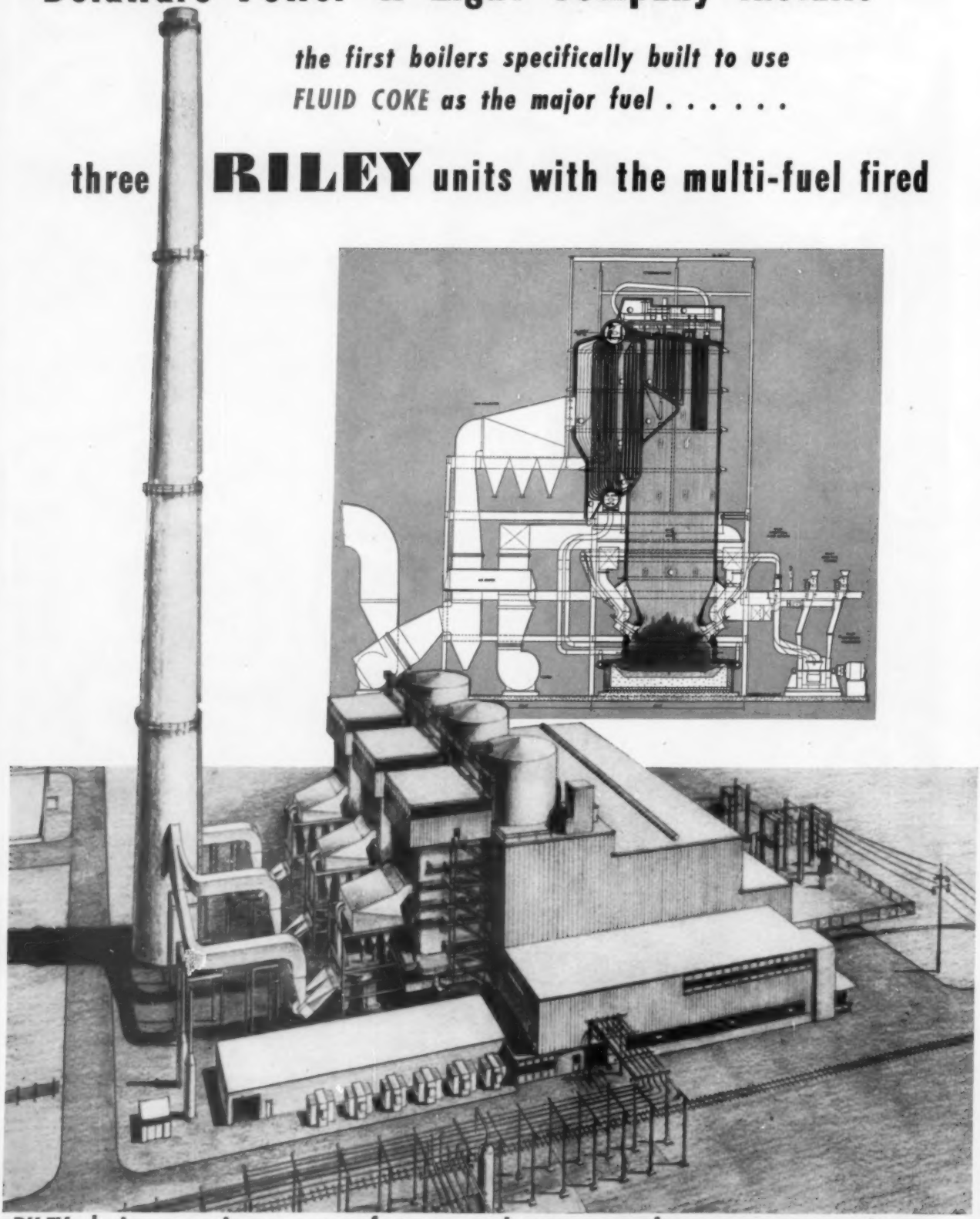
DRAWING NO. AE-3593-1

Edward builds Globe and Angle Stop, Non-Return, Check, Stop-Check, Gate, Blow-Off, Mudline, Relief, Hydraulic, Instrument, Gage, and Special Valves and Strainers.

Delaware Power & Light Company installs

the first boilers specifically built to use FLUID COKE as the major fuel . . . . . .

three RILEY units with the multi-fuel fired



RILEY designs, engineers, manufactures and erects complete steam generating

TURBO FURNACE

Delaware Power & Light Company selected three Riley TURBO FURNACE units for its Delaware City Power Station which will supply steam and electric power requirements of Tide Water Associated Oil Company's new 130,000 barrel-per-day Flying "A" Refinery in Delaware. These units were designed particularly for efficiently firing fluid coke with a minimum of auxiliary fuel.

To burn low volatile fluid coke a furnace providing high heat concentration, high turbulence and sufficient residence time for burnout is necessary . . . and Riley's TURBO FURNACE meets these requirements. The coke, pulverized by Riley Mills, is introduced into the furnace combustion chamber by Riley Directional Flame Intertube Burners arranged for opposed firing. Fluid Coke is largely carbon; therefore, a reinjection system is used to burn the catch in the dust collection system. The design of the burners and the TURBO FURNACE will also permit the burning of refinery gas, oil and coal.

C. F. Braun & Co — Engineers and Constructors

ADVANTAGES of RILEY TURBO FURNACES

- Efficiently uses a wide range of coals, oil, natural and refinery gases, fluid coke, delayed coke, lignite.
- Lower carbon loss, higher efficiency
- No slag blowers required
- No stratification of furnace gases
- No fly ash disposal problem
- All burners on one level
- The same furnace exit gas temperatures with all fuels
- No change is needed in pressure parts regardless of fuels
- Lower overall height

DELAWARE CITY POWER STATION
Three Riley TURBO FURNACE Units
Steam Capacity — Each 500,000 lbs/hr.
Design Pressure — 1425 psig
Steam Temperature — 950 F.
Fired by Riley Mills

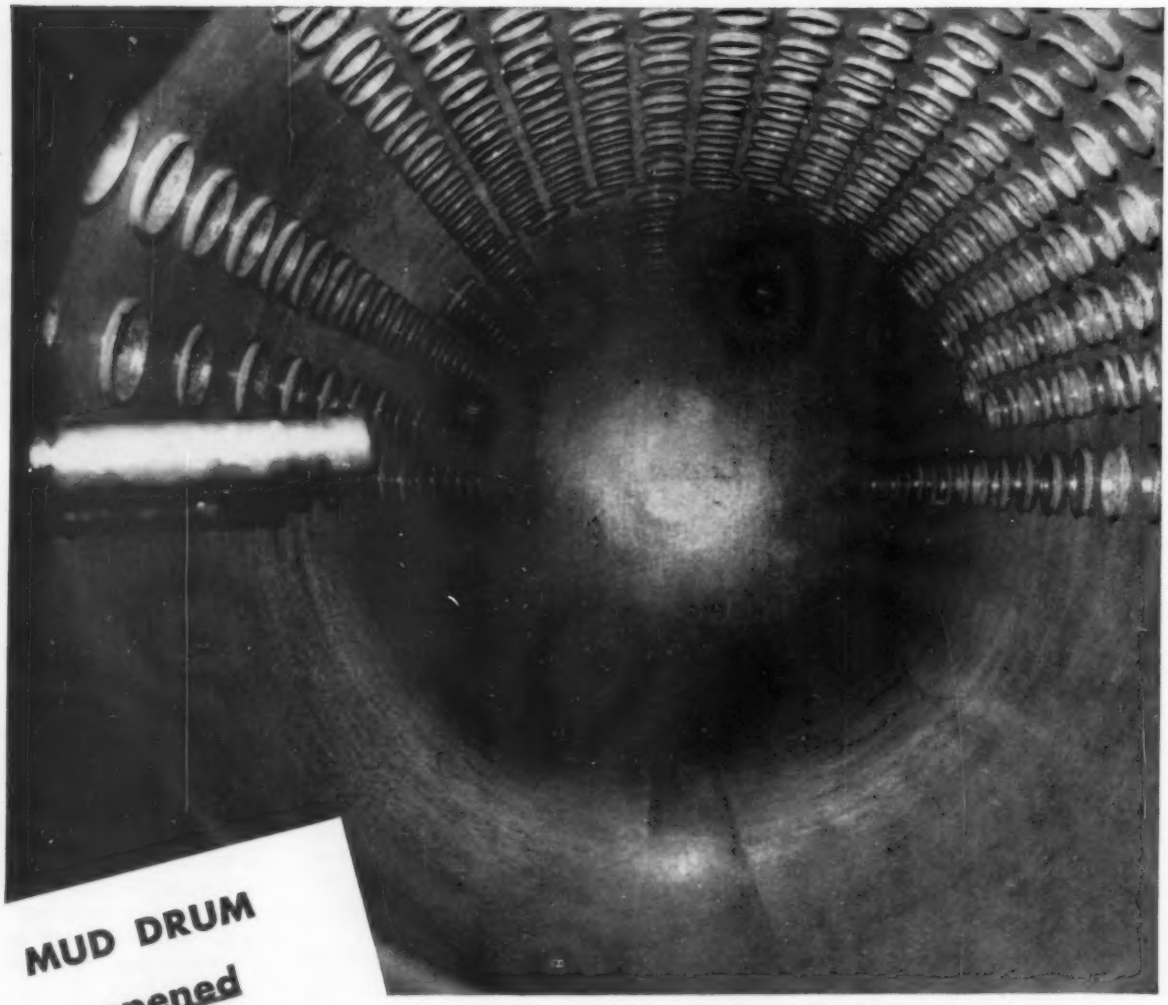
A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

units for Public Utility Central Stations and Industrial Power and Heating Plants

For more data circle 513 on Post Card



MUD DRUM as opened after one year on line with THE *Nalco* SYSTEM

Unretouched photo of Nalco treated boiler at Georgia Institute of Technology, Atlanta, Georgia

● Calling this a mud drum serves only to identify its location . . . it is perfectly clean after a full year on line. The unretouched photo was taken immediately after the drum was opened. No wash-out was necessary. Not only is the drum free of scale and corrosion . . . Nalco sludge conditioning operated so effectively that even under the static, off-line draining condition, no sludge deposited in tubes or drums.

The Nalco System can get results like these, economically, in *your* plant—regardless of boiler size or pressure. Write or phone Nalco today for action on a complete water treatment program.

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HELPFUL BULLETINS

INSTRUMENTS AND CONTROLS

101 Motor Control Center — Described in 24-pp Bulletin GEA-6367 is a compactly designed general-purpose motor control center permitting savings up to 50 per cent in floor area. It is designed to accommodate starter units of either the fusible or circuit-breaker type in NEMA Sizes 1 through 5. Bulletin lists ratings, weights, dimensions, installation data and guide form specifications. Nine major features of the control center are illustrated and explained. General Electric Co.

102 Heating Controls — Bulletin NR-26 describes use of automatic time controls with oil burners, gas units and stoker. Standard timer applications are listed together with type of time control required for each. A brief description of switch action on temperature control is given for each application. Wiring diagrams accompany suggested uses. Control of various types of thermostats, singly and in combination, is illustrated. International Register Co.

103 Combustion Controls — Included in this catalog (about 16 pp) are product descriptions of company's combustion instruments and controls. Covers damper controls; drive units; draft, air pressure and flue temperature gages; steam controls; panel board cabinets; low-draft cut-off switches. Pages are fully illustrated to show design and operational details, and brief text includes application suggestions, special features. An oil burning manual of information is included with this catalog. Cleveland Fuel Equipment Co.

104 Heating Controls — Condensed Heating Catalog, Spring 1956, is a 52-pp ordering book on automatic heating controls. Many new items, including a line of oil, coal and electric controls, plus recent improvements and changes in company's line of gas heating controls. Indexed both by product classification and model numbers, book presents ignition systems, fan and limit controls, humidity controls, low water cutoffs, meters, burner controls, regulators, thermostats, valves, many others. General Controls.

105 Temperature Controllers — Bulletin 1025B describes company's LSI electric indicating temperature controller. A simplified operational sketch shows how unit can be used to provide sequence control combinations such as: step-heating, heating and cooling, wide differential control, holding and operating temperatures, and also temperature control plus operation of signal devices. Sarco Co., Inc.

106 Manometer Instruments — Bulletin G-10 is a quick-reference guide to manometer-type instruments. Sets forth four basic types of manometers ranging from simple U-tube to ultra-precision models and provides selection tips. Specialized manometer instruments are also described for pressure, vacuum, flow and liquid level services as well as electrical contactor-type manometers and portable manometer kits. Range, working pressure, applications are given for each instrument. The Meriam Instrument Co.

107 Pressure Gage — Description and principle of operation for company's high temperature pressure gage is presented in illustrated Bulletin PG-2. Installation and specification data is also included. Callery Chemical Co.

108 Electric Thermostats — Revised Bulletin 1000B describes electric room thermostats for industrial plants and institutions. Also featured are immersion thermostats for hot water heating systems, unit heaters and alarm circuits, and surface thermostats for low limit control on unit heaters. Sarco Co., Inc.

VALVES, PIPING, FITTINGS

109 Regulating Valves — Bulletin 1027 describes basic control regulating valves which feature greater versatility and wider application. A complete description of the valves is given, including specifications for each and information on pressure reducing and desuperheating stations, along with package controls. Copes-Vulcan Div., Blaw-Knox Co.

110 Rubber Pipe — Catalog SZ-55 features engineering data on SoundZorber — a wire-reinforced rubber pipe for eliminating noise and vibration from water lines. Details construction, operating characteristics, temperature and pressure ranges, and illustrates typical installations, noise, vibration and water hammer control, dimensions and comparisons of acoustical impedance. Industrial Div., T. R. Finn & Co., Inc.

111 Pipe Nipples — Catalog 755, 16-pp, carries information about pipe nipples, with list prices, carton quantities, weights and ASTM specifications. Pipe nipple industry terms are explained, and sizes and lengths of all close, short, butt and special nipples are listed. Method of stocking pipe nipples, order filling procedure, engineering specifications that products meet, thread gages available, and pipe bending facilities covered. Pittsburgh Nipple Works, Inc.

112 Data on Fittings — This 12-pp handy pocket catalog contains basic information on forged steel screw-end and socket-welding fittings, forged stainless and alloy steel fittings, 150-lb stainless fittings, unions and special fittings, also hydraulic pumps and jacks. Sizes, ranges, types, materials of construction and design features are included. W-S Fittings Div., H. K. Porter Co., Inc.

PUMPS, COMPRESSORS

114 Centrifugal Pumps — Bulletin 4011-A, 12-pp, describes company's complete line of redesigned and resized end suction centrifugal pumps designed to handle different liquids. Performance tables and curves list characteristics of all possible combinations. Photos, cutaway views, are included. The Deming Co.

115 Controlled Volume Pumping — Technical Paper 65, 8-pp, covers factors governing accuracy in controlled volume pumping. Test procedures and results of investigations into metering accuracy are recorded. Describes how controlled volume pumps are used as flow control instruments in both open and closed loop instrumentation systems. Typical systems are illustrated. Milton Roy Co.

116 Centrifugal Pumps — Bulletin 1030 illustrates and describes Series S Chempumps, latest addition to company's line of seal-less centrifugal pumps. Performance curves and dimension drawings are included along with a discussion of operating principles and list of specifications. Chempump Corp.

117 Turbine-Type Pumps — Eight-pp Bulletin 111 describes company's master turbine-type pumps, with assembled and exploded views illustrating important design features. Shows cross sections of single and two stage pumps and features construction specifications for pump parts requiring corrosion alloys for special liquid handling purposes. Aurora Pump Div., The New York Air Brake Co.

118 Centrifugal Pumps — Circular 190, 6 pp, describes standard centrifugal pumps for general and chemical service. Design features are discussed, materials of construction are listed; and simplicity of design and parts interchangeability are explained and illustrated. Also included are design specifications. Dean Brothers Pumps, Inc.

119 High Pressure Pumps — Application of company's horizontal Triplex pump in 10 different industries is covered in Bulletin P-55, along with the construction and operation of the mechanism. Shows five basic cylinder designs meeting requirements of a wide range of pumping applications. A specification chart is included, also graphs covering machine selection and typical power curves. Manton-Gaulin Mfg. Co., Inc.

120 Hand Pumps — Double action, piston-type hand pumps of 20-gpm capacity are described and illustrated in Bulletin 3011. Design and construction details are provided and applications suggested. Also provided are specifications and data on fittings. Bowser, Inc.

New and revised publications reviewed on these pages offer help on operating and maintenance problems. To order, use the Reader Service Cards, page 113.

121 Pumps, Valves — Technical data on company's line of centrifugal pumps and valves is provided in 20-pp Bulletin 1055. Includes descriptive information with photos, dimensional drawings, data tables and performance curves of the pumps. Also included are descriptions of the various valves — gate valves, check and butterfly valves — manufactured. Valves listed are constructed to resist abrasive action of solids bearing waters. McNally Pittsburg Mfg. Corp.

122 For Process Industries — All types of air and gas compressors used in the process and chemical industries are shown in 8 pp Form 3132-A. Shows centrifugal and reciprocating units, with

electric, steam, gas and diesel power, for pressures from deep vacuum to 35,000 psi and capacities to 165,000 cfm. These compressors are pictured in operation on such varied jobs as refining, drug manufacture, chemical production. They handle chlorine gas, hydrogen, ammonia, hydrogen chloride, other gases and air. Also shown are 15 basic types from which most combinations are designed. Ingersoll-Rand Co.

123 Portable Compressors — Form 2313 features the Gyro-Flo 900 rotary portable compressor, which delivers 900 cfm of air yet retains lightweight, compactness of company's line of compressors. Photos, schematic drawing illustrating component parts and specifications are included. Ingersoll-Rand Co.

BOILERS, AUXILIARIES

124 Packaged Generators — Bulletin MH 3–54, 14-pp, gives detailed coverage to company's Type MH packaged water tube steam generators which are furnished for oil or gas firing or both, with automatic, semi-automatic, or manual controls. Included are: cutaway illustrations, installation photos, tube arrangement layouts, a photo-sequence story of actual shop assembly construction, auxiliary equipment available and dimension table. Union Iron Works.

125 Draft Inducers — Sixteen-pp Bulletin I-56 on draft inducers for heating boilers and for power plants, lists such new features as interchangeable inlet panels and fan drive through V-belt with motor mounted on a spring base to maintain belt tension. Typical installations are pictured and typical specifications included. Bulletin also contains a readily understood selection table for most heating plant installations and selection curves for use in selecting draft inducers for power plant installations. L. J. Wing Mfg. Co.

126 Draft Fans — This 8-pp bulletin describes and illustrates manufacturer's Galex Airfoil type draft fans, recently redesigned to take care of the more severe draft requirements of power plant operations. Features and operating principle are discussed. Also provided are specific speed curves, dimensions and selection data. The Green Fuel Economizer Co., Inc.

127 Gas Burners — Bulletin G-200-B describes company's Fan-Air gas burner for forced, induced, or natural draft operation in power plants. A cutaway view showing important features is included, along with specifications. The Mettler Co., Inc.

ELECTRICAL, LIGHTING

128 Distribution Regulators — How this company's distribution regulators increase revenue, reduce service costs and improve customer relations for utilities is told in 16-pp Bulletin 21B7977A. Describes unit construction, and other features of the regulators. Also includes specifications, photos of typical installations, and data on standard accessories. Allis-Chalmers Mfg. Co.

129 Automatic Recloser — Information on company's Type HR automatic recloser with hydraulic timing mechanism is offered in Bulletin GEC-1374A. Compatible with other hydraulic reclosers, the unit is now available for 14.4 kv at 50 amp. Bulletin includes product features, application information, ratings, dimensions and prices. General Electric Co.

130 Control, Transfer Switches — Bulletin GEA-4746B covers control and transfer switches for low voltage applications up to 600 v, a-c or d-c. Includes photos, drawings, cutaways and discussion of special features. Switches with watertight and explosion-proof housings are described. Bulletin also contains application data, representative contact diagrams and ordering tips. General Electric Co.

131 Vertical Pump Motors — Containing full-colored illustrations and technical drawings depicting features and applications of vertical turbine pump motors, Bulletin 1903, 16-pp, describes hollow shaft Verticlosed grease- and oil-lubricated motors in sizes from 1½ to 400 hp. Also covers single-phase designs up to 7½ hp, and totally-enclosed types up to 150 hp. Graphs showing relation of thrust bearing life to contact angle, starting characteristics of part-winding increment start motors are included. U. S. Electrical Motors Inc.

132 Current-Limiting Busway — Bulletin GEA-6469, 8-pp, describes the Type CL electric busway having reactance values eight to 23 times those of conventional feeder busways. Discusses construction and application, and lists ratings, weights, dimensions, installation data, and specifications. General Electric Co.

133 Feeder Busway — A low-impedance feeder busway system for general-purpose power distribution applications where heavy loads are served or low-voltage drop is essential is described in 16-pp Bulletin GEA-6151. Covers construction and application of company's enclosed bus-bar system. Also lists ratings, weights, dimensions, installation data, and guide form specifications. General Electric Co.

134 For Better Transformers — How quality control results in better transformers is told in 16-pp Bulletin 61B8355. Explains how acceptance tests and inspections are a constant check on quality of materials before manufacturing, and how process and quality controls, production line tests and inspections insure high quality in materials and workmanship during manufacturing to produce a quality distribution transformer. Allis-Chalmers Mfg. Co.

135 On Instrument Transformers — Now available is the 80-pp 1956 edition of this company's Instrument Transformer Buyer's Guide. Gives vital facts and figures on a complete instrument transformer line, including recent additions to the group of butyl-molded current transformers. Covers potential transformers, current transformers, metering outfits, portable transformers, Thyrite protectors. Fully illustrated, includes list prices. General Electric Co.

136 Recording Instruments — Catalog Section 40–55, 8-pp, features direct current ammeters, voltmeters and millivolt-voltmeters using the permanent-magnet moving-coil measuring elements. Describes component parts, contains charts and specification data. The Esterline-Angus Co., Inc.

137 Power Supplies — Condensed standard specifications on a wide range of power supplies, voltage regulators, voltage reference sources, frequency changers etc. are provided in this 1956 catalog. Included are data on regulation accuracy, input and output voltages, ripple, recovery time, load range. Also listed are local technical representatives and service facilities. Sorensen and Co., Inc.

138 Off-Peak Control — Bulletin GEC-981A, 12-pp, gives all the vital facts and figures on company's time switches and combination watthour meter-time switch for registration and control of off-peak water-heater load. Photos, diagrams and specifications are included. General Electric Co.

139 Improved Lighting — "Better Industrial Lighting with Mercury Vapor" is a 12-pp booklet devoted to showing how a power engineer can improve seeing and working conditions at lower cost. Contains a summary of eight basic advantages of using mercury vapor lamps and shows ten typical applications of these lamps in industrial plants. Also provides a section on engineering hints for effective installations, as well as information on how to combine mercury vapor lamps with fluorescent or incandescent lighting. Sylvania Electric Products Inc.

MECHANICAL POWER TRANSMISSION

140 Shaft-Mounted Reducers — Details on shaft mounted speed reducers are presented in 12-pp Bulletin CD-400. These reducers utilize double-enveloping worm gear design and are claimed to provide greater load-carrying capacity, size for size, than possible with many right-angle reducers. Dimensioned assembly drawings, horsepower and torque rating charts, and application photos illustrate booklet. Specifications on bore sizes and gear mountings, plus mounting instructions are included. Cone-Drive Gears Div., Michigan Tool Co.

141 On Flexible Shafting — Described and illustrated in this 20-pp booklet are flexible shafting, flexible housing and tubing, and flexible shaft assemblies. Construction advantages, characteristics and selection and application information are provided. Includes inch-pound torque transmission tables, other engineering data. Several pages are devoted to typical flexible shaft assemblies. Walker-Turner Co., Inc.

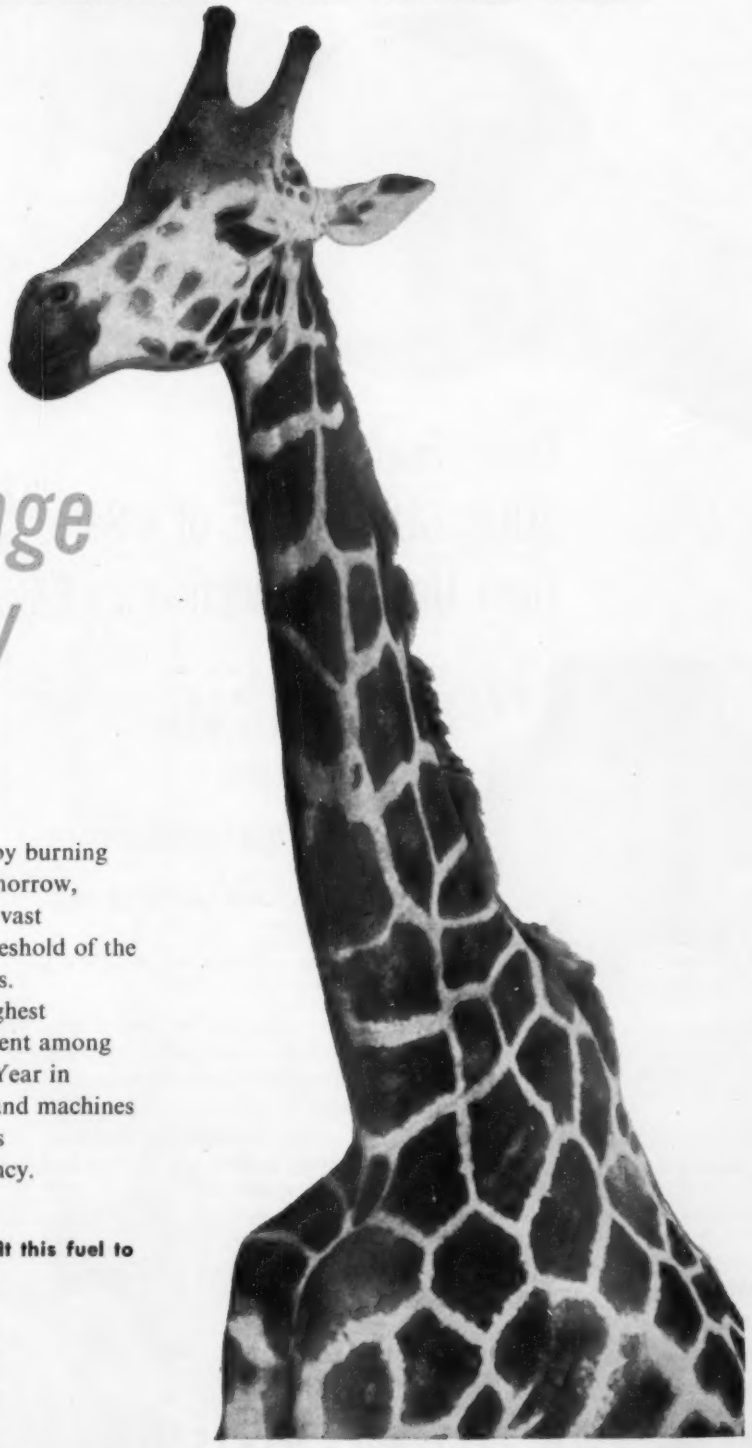
142 V-S Transmission — Infinitely-variable speed transmissions are generously illustrated and concisely described in 28-pp Catalog 65. Construction, accessories, and controls, both manual and automatic, are classified. An engineering section indexes and tabulates power transmission characteristics, ratings and dimensions. Ordering specifications are included. Lewellen Mfg. Co.

143 D-C Magnetic Brake — Booklet B-6548 describes a self-adjusting d-c magnetic brake, suitable for all types of d-c motors. Containing many illustrations, booklet covers in detail the construction, operation, and applications of this brake, which, through the use of rectifiers, can be applied to a-c motors. Westinghouse Electric Corp.

144 Report on Fan Clutches — This technical report, about 10 pp, analyzes engineering features and operating advantages of custom-engineered fan clutches available for internal combustion engines. Lists advantages gained through application of a fan clutch to an engine. Fan clutch operation and methods of control are described in detail, with varying types of mountings listed. Warner Electric Brake & Clutch Co.

145 Improved Sprockets — Brochure 1–56 describes and illustrates man-

UNCERTAIN OPERATING COSTS BOTHER YOU?



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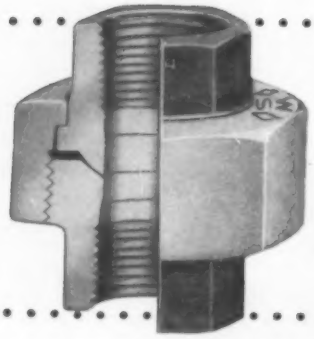
These Features are YOUR GUARANTEE of a Safe, Tight Union Connection:



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2. SPHERICAL-TO-ANGLE MATING SURFACES
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W-S Forged Steel Unions give you the kind of protection you need in high pressure piping systems. They're designed with precision-machined spherical-to-angle mating surfaces for positive seating, free from leaks even when pipes are slightly out of line. Cadmium-plated nuts resist galling and seizing and forged steel construction gives you the extra strength you need in high pressure service.

W-S Unions are available in 3000 lb. class, sizes ⅛" to 3" in screw-end and socket-welding types. Send today for your copy of Bulletin U-1.

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ganese-steel sprockets and points out advantages of using Tisco sprockets with removable tooth segments. Stresses longer service afforded by these sprockets. Also illustrates drag conveyor and combination chains for use in cement, paper, quarrying industries. Taylor Wharton Div., Harrisburg Steel Corp.

. . . Outstanding Among This Month's Catalogs

146 On Rust Prevention — This 1956 General Catalog, 28-pp Form 255, presents a treatise on rust prevention with illustrations of Rust-Oleum uses and applications throughout industry. Included are 102 color chips showing variety of colors available in primers, short oil type coatings, oil field finishes, restful color group finishes, machinery and implement colors, long oil type coatings, calvinoleum coatings, heat resistant coatings, chemical resistant coatings, and floor and deck coatings. Rust-Oleum Corp.

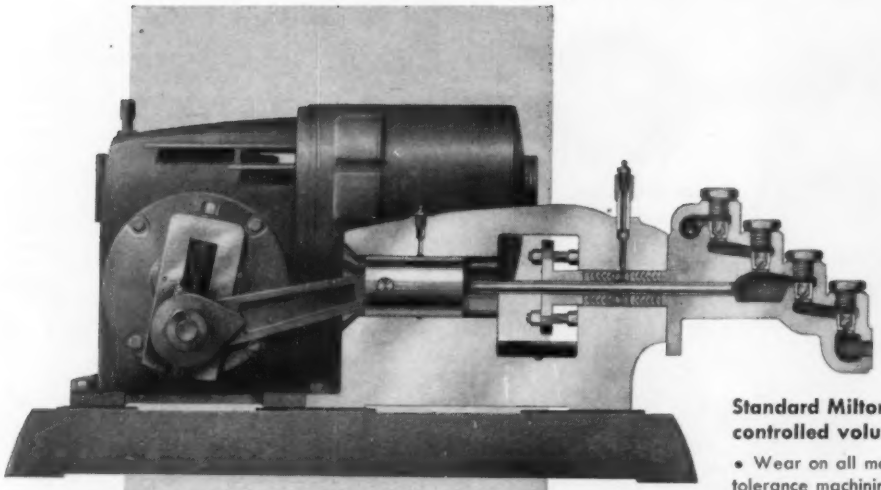
147 Plug-In Busway — Twenty-pp Bulletin GEA-6470 describes the factory-assembled Flex-A-Power plug-in busway system permitting direct connection to bus bars for feeding lighting and power loads in industrial plants and public buildings. Describes in detail the construction and application of this busway system. Also lists ratings, weights, dimensions, installation data and guide form specifications. General Electric Co.

148 Insulations, Refractories — This 20-pp catalog features thermal insulations and refractories for general industrial applications. Organized for quick reference, catalog provides information on composition, physical and thermal properties and sizes of the various products. Lists chief advantages, covers materials for efficient control of temperatures from — 400 F to 3,000 F. Johns-Manville.

149 Radiant Heating Construction — This 8-pp report concerns accepted installation procedures for radiant heating systems. Various types of construction are sketched, and each sketch shows position of the wrought iron pipes in the concrete slab, and the relation of coils and slab to the structural features of both on grade and above grade construction. Contained in a digest of construction recommendations are discussions of floor surfacing, heating slab, radial heating coils, insulation base or fill, as well as waterproof membrane and support brackets. A. M. Byers Co.

TOOLS AND WELDING

150 Handy Fastening Tool — Two booklets show different ways in which this fastening tool can be used. One booklet shows how the tool can be used for plant maintenance — fastening conduits, bus ducts, junction and outlet boxes, surface raceways, fixtures and frames, duct straps, fan and blower mounts, sprinkler pipes, partition plates. The second booklet tells how it can be used for lead lining. Tells how to line heavy wall steel tanks, thin wall steel tanks, wood tanks, concrete tanks and storage rooms. Also discusses general ap-

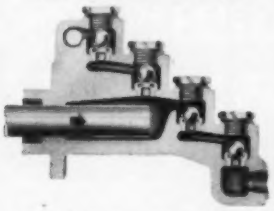


Standard Milton Roy motor-driven controlled volume pump.

• Wear on all moving parts minimized by close tolerance machining of cross-head, pump frames and liquid end parts. • Excessive packing wear avoided by large length-to-diameter ratio of cross-head which fully supports plunger. • Long service life under shock and oscillating loads assured by generously-sized reducer and connecting rod bearings.

Dependability for metering process additives

Exclusive Milton Roy
STEP-VALVE LIQUID END



Double ball checks, sloping passages and absence of air pockets assure highest possible volumetric efficiency. Should a solid particle lodge under one suction ball, for example, second suction ball will seat on discharge stroke, thereby preventing fluid from being pumped into suction piping.

MILTON ROY dependability means long service life in your controlled volume pump . . . minimum maintenance . . . lower operating cost.

Here's why. Designed-in dependability is the result of extreme care in the sizing of motor horsepower, reducer torque and overhung load capacity. Reducer, motor and pump mounting pads on a rigid, webbed base are precision machined to assure perfect alignment of the entire assembly . . . and of all moving parts.

Specify Milton Roy . . . your guarantee of dependability in controlled volume pumps and complete chemical feed systems. A practical solution to your metering problem will be found in one of the following bulletins. Write for your copy today.

Bulletin 455 "Controlled Volume Pumps in Paper Making."

Bulletin 953 "Controlled Volume Pumps in Industrial Water Treating."

Bulletin 1253 "Controlled Volume Pumps in Process Instrumentation."

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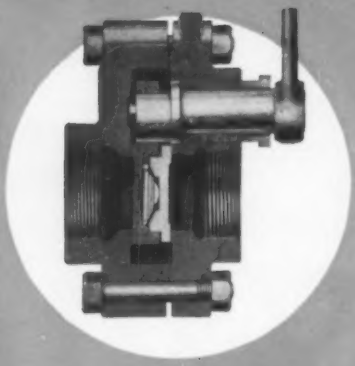

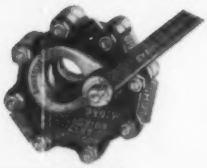

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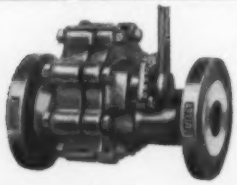

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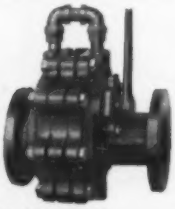
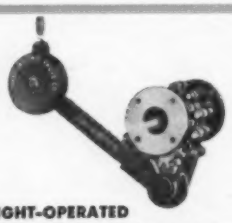


STEAM JACKETED
Assures free flow of viscous materials.



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For automatic drains or emergency shut off.

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- straight-through full flow
- self-grinding rotating disc
- valves that cannot wedge or jam

then you want an Everlasting Valve

No other valve has all the Everlasting features . . . proven by half a century of service to assure dependable, leak-tight service.

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plications of lead lining. Olin Mathieson Chemical Corp.

151 Welding Facts Illustrated — Described as a "picture book of facts on company's welding processes," 16-pp Form TIS 2367 provides helpful information on the "low heat input" metal-joining process. Explains how it combines advantages of low application heats of brazing with greater strength of fusion welding. Technical data tells how company's Low Temp EutecRods and Low Amp EutecTrodes minimize or eliminate residual stresses, cracking and distortion of base metals. Test reports are provided and several pages are devoted to case histories. Eutectic Welding Alloys Corp.

SAFETY, SANITATION

153 Special Fire Protection — Bulletin 73, 28-pp, covers fire detection, fire prevention, fire control and fire extinguishment associated with special hazard fire protection. Tells what special hazard fire protection is, describes application, economies, and covers methods of fire detection, such as rate-of-temperature-rise detection, flame or flash, smoke and vapor detection. Methods of fire prevention, control and extinguishment are treated and application photos included. A fire control chart is included. Automatic Sprinkler Corp. of America.

154 Washing Equipment — Catalog 5601, 28 pp, illustrated in full color, shows a full line of group washing equipment and drinking fountains. Wash fountains, bowls, showers, and accessories are covered. Book contains information on company's new "floating" type foot mechanism and counter type fixtures as well as data on comparative costs and advantages of group washing versus individual wash fixtures. Bradley Washfountain Co.

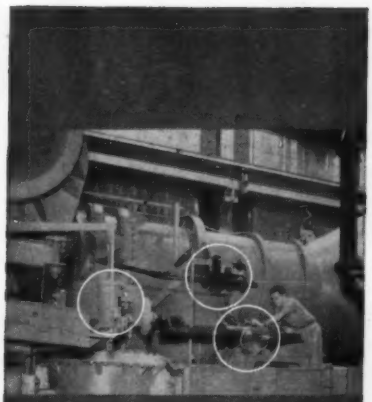
OTHER EQUIPMENT

155 Heaters and Heating Devices — Bulletin GEC-1005G, 60-pp, contains application index, calculating data, specifications, operating information, and list prices of standard heaters and heating devices. Included are immersion, strip, cartridge, tubular, fin heaters, unit heaters, soldering irons, glue pots, soft-metal melting pots, oven equipment, and control. Process and application index shows methods of heating and type of heater recommended for various heating processes. General Electric Co.

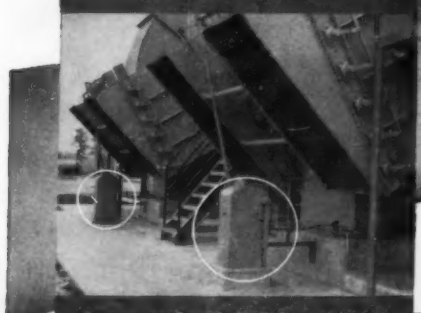
You'll save time in ordering bulletins by using the Reader Service Cards on page 113. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

156 Rubber Parts, Products — In file folder form, this brochure describes company's facilities for producing custom-made rubber parts and components. Laboratory facilities, fabricating techniques are covered. Representative products are shown, including seals, O-rings. Goshen Rubber Co., Inc.

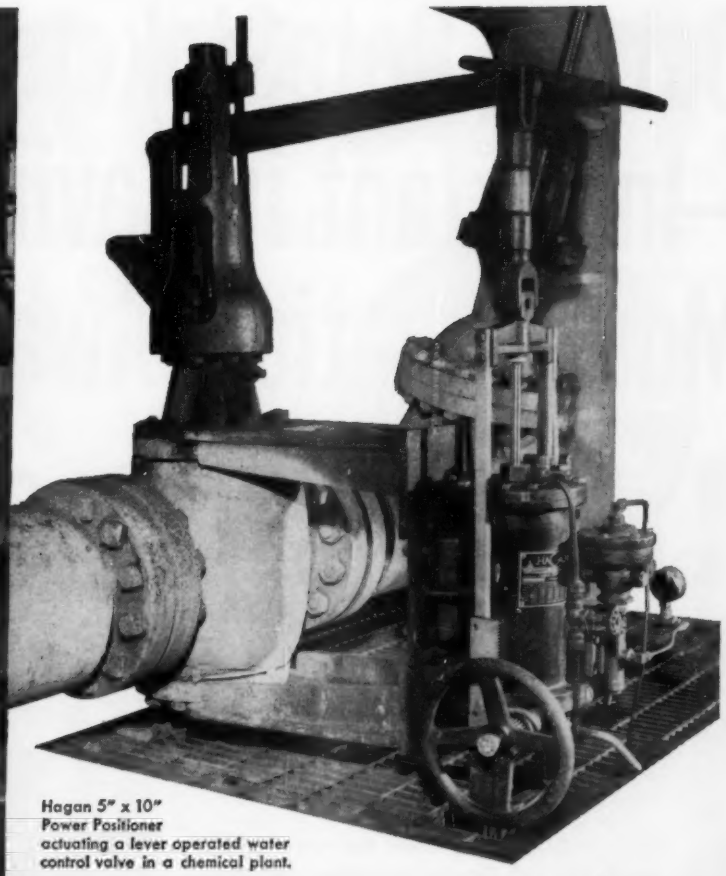
157 Cooling Units — Bulletin C-1100-S105 describes company's Flexi-Cool



Two 8" x 20" and one 5" x 20" Hagan Power Positioners operating plug valves on a wind tunnel in an aeronautical test facility.



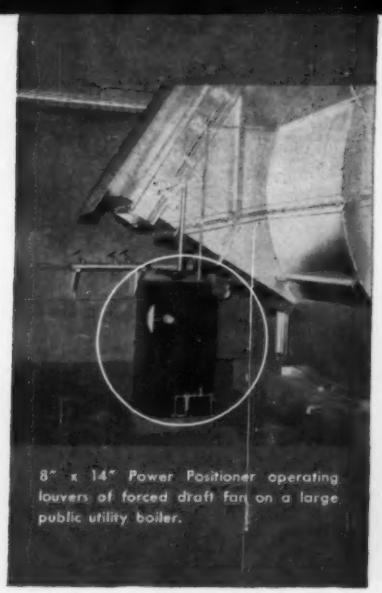
Louvers on forced draft fans operated by Hagan 6" x 10" Power Positioners. Note outdoor installation.



Hagan 5" x 10" Power Positioner actuating a lever operated water control valve in a chemical plant.

HAGAN POWER POSITIONERS

HIGH PRECISION—LOW MAINTENANCE!



8" x 14" Power Positioner operating louvers of forced draft fan on a large public utility boiler.

Hagan Power Positioners provide the "muscles" for thousands of control applications in every type of industry—wherever torque and positioning accuracy requirements are severe.

Hagan Power Positioners are economical, both in first cost and in the low maintenance costs which result from their uncomplicated design and strong construction. Many Hagan units are still giving trouble-free, dependable service after years of exposure to rigorous conditions, such as high ambient temperature (up to 160°), corrosive atmospheres, or outdoor installations.

Hagan Power Positioners can help you lower costs in all your final power drive needs. Write for Specification File TP-MFI for information on the full range of these powerful "Muscles for Industry."

HAGAN CORPORATION

HAGAN BUILDING, PITTSBURGH 30, PA.

HAGAN

Systems and Components for: Boiler Combustion Control, Metallurgical Furnace Control, Process Control, Aeronautical Testing Facilities • Industrial Water Treatment • Chemicals for Water Conditioning

HAGAN SUBSIDIARIES: CALGON, INC. • HALL LABORATORIES, INC.

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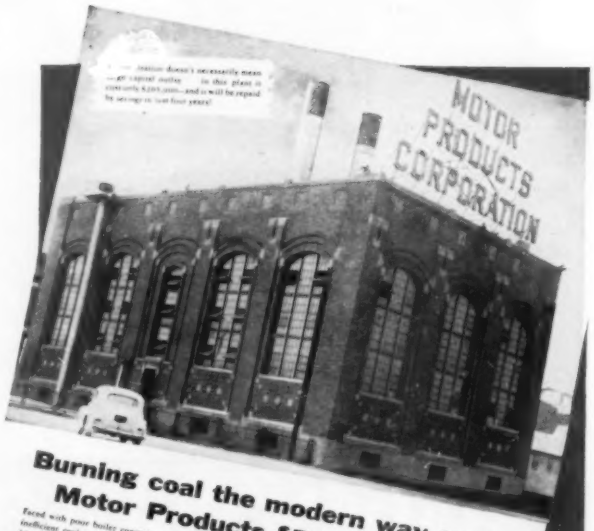
Detroit RotoStokers Type C-C —Important in Savings by this Modernization Award Winner

Motor Products Corporation, Detroit, won a "Power" Modernization Award with a program in which Detroit RotoStokers, Type C-C played an important part. Savings will pay for the investment in four years.

The Type C-C is a spreader stoker that automatically cleans the fuel bed and discharges the ash continuously at the front. It operates without smoke through a wide load range — important to a plant located in the midst of a city, such as Motor Products Corporation.

Let us tell you more about the economies available with Detroit RotoStoker, Type C-C.

Write for Bulletin — No Obligation.



Burning coal the modern way saves Motor Products $54,000 a year

facts you should know about coal

Motor Products Corporation—Detroit
R. B. Gibney, Plant Engineer.

Soddy, Benjamin & Woodhouse Inc.,
Detroit, Consulting Engineers.

Power MODERNIZATION PROGRAM

DETROIT STOKER COMPANY
GENERAL MOTORS BLDG. — DETROIT 2, MICH.
DISTRICT OFFICES IN PRINCIPAL CITIES — WORKS AT MONROE, MICH.

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units which are factory assembled for a wide variety of air conditioning applications. Illustrates ways in which Flexi-Cool can be arranged, and shows relative positions of basic components — cooling cycle, blower, filter, and plenum sections — as well as giving piping and duct sizes. Worthington Corp.

158 On Alkalinity Reduction — Technical Reprint T-142 discusses the details of dealkalization, a method of alkalinity reduction. This process is also known as sodium zeolite-anion exchange and offers advantage of not requiring corrosion resistant equipment. This article discusses the details of the process and where it can be used. Actual chemical equations show how the reaction takes place. Graver Water Conditioning Co.

159 On Moisture Control — "Air, Water and Industry" is a 20-pp pocket-size booklet covering some compressed air problems and how to solve them. Tells why there is moisture in air lines, how it got there, and why its action is destructive. Booklet is fast reading, cleverly illustrated and includes table of approximate air needs of air tools. A companion piece to this booklet is a revised bulletin describing the Vi-Speed method for removing moisture from air, hydrogen, nitrogen and natural gas lines. It includes model specifications, dewpoint chart. Van Products Co.

160 Barometric Condensers — Twelve-pp Bulletin 5AA describes barometric condensers for removing air, exhaust steam, and other vapors from vacuum equipment. Covers condenser theory, basic condenser types, features, application and construction information, and condenser operation. Also included is information on selecting condensers under varying conditions. Tables giving capacities, dimensions, and weights, along with sectional drawings are included. Schutte and Koerting Co.

162 Fabrication Facilities — Specialized manufacturing facilities for fabrication of pressure vessels, high pressure piping and unusual weldments, custom-designed to specification, are described in 18-pp illustrated Bulletin GS-56-4. Types of special equipment made at the plants described include reaction vessels, autoclaves, fat splitter towers, steam accumulators, nuclear power plant steam generator-heat exchanger vessel and aluminum towers. Foster-Wheeler Corp.

163 Ceiling Diffusers — Catalog F 7722 features design and application data on the Model BP Venturi-Flo Diffuser. Includes performance data as well as information concerning physical characteristics of the unit. Barber-Colman Co.

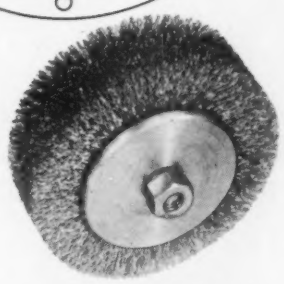
164 How to Care for Gloves — This 18-by-22 in. poster shows how to care for the rubber gloves used by those who handle hot wires. Containing no advertising matter, this illustrated poster tells how to inspect gloves, how to handle and store them, and how to prevent and find damage to them — so that maximum use and protection can be had. Poster is suggested for bulletin board and locker room display. The Charleston Rubber Co.

165 For Bulk Handling — Bulletin 955, 34-pp, describes equipment for handling bulk material such as rock, gravel and coal. Includes information on conveyors, chain, feeders, elevators, hoppers and drives. Photos, dimensional drawings, data tables and specifications are included. McNally Pittsburg Mfg. Corp.

ROTOJET®
Tube Cleaners

Clean tubes and pipes from ½" to 12" I.D. THOROUGHLY QUICKLY

ROTOJET Model 512 Air-driven Motor, universal joint, swing-frame head, and solid brush.



Our large stock of Rotojet air-driven and water-driven tube cleaners, accessories, and repair parts for straight and curved tubes, pipes, and transfer lines is available to meet most requirements without delay. Tube cleaner specialization for 43 years assures satisfactory results from any Rotojet equipment we recommend. Send for Bulletins J-410 and R-105. For quick action wire or phone, HUmboldt 3-0570.

ROTOJET Junior Model S32 Air-driven Motor, universal joint, cone cutter.

ROTOJET Junior Model C434 Air-driven Motor, flexible coupling, expanding brush.

ROTOJET Model C-525 Air-driven Motor with swing-frame head and universal joint.

ROTOJET Model C-526 Air-driven Motor with pivot head and universal joint.

ELLIOTT COMPANY - ROTO DIVISION

Tube Cleaner Specialists Since 1910

147 Sussex Avenue, Newark, N. J.

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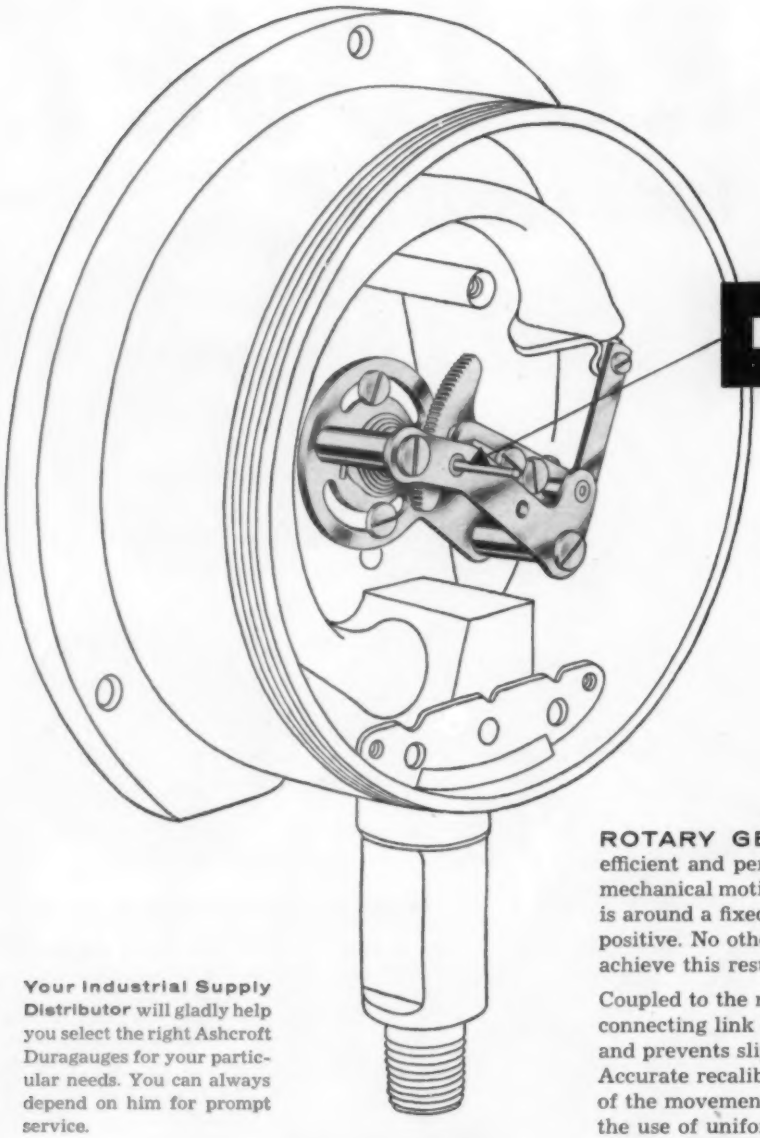


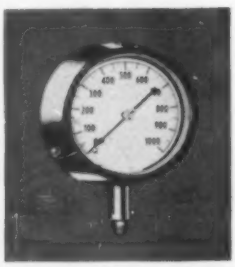
Why does the **MOVEMENT** in the ASHCROFT DURAGAUGE outperform all other types?

ROTARY GEARED MOTION, the most efficient and perfect method of transmitting mechanical motion ever developed. Because rotation is around a fixed center, pointer position is always positive. No other type of movement can ever achieve this result.

Coupled to the movement is a one-piece connecting link that guarantees correct calibration and prevents slippage or parting under tension. Accurate recalibration is easy from front or rear of the movement. Universal adjustability permits the use of uniformly graduated dials, thereby facilitating maintenance.

The Ashcroft Duragauge is available with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. There are case designs and materials, Bourdon tube materials, pressure ranges and dial sizes to meet your service conditions exactly. Save time, trouble and money. Specify the pressure gauges of highest sustained accuracy and durability – Ashcroft Duragauges.

Your Industrial Supply Distributor will gladly help you select the right Ashcroft Duragauges for your particular needs. You can always depend on him for prompt service.



In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

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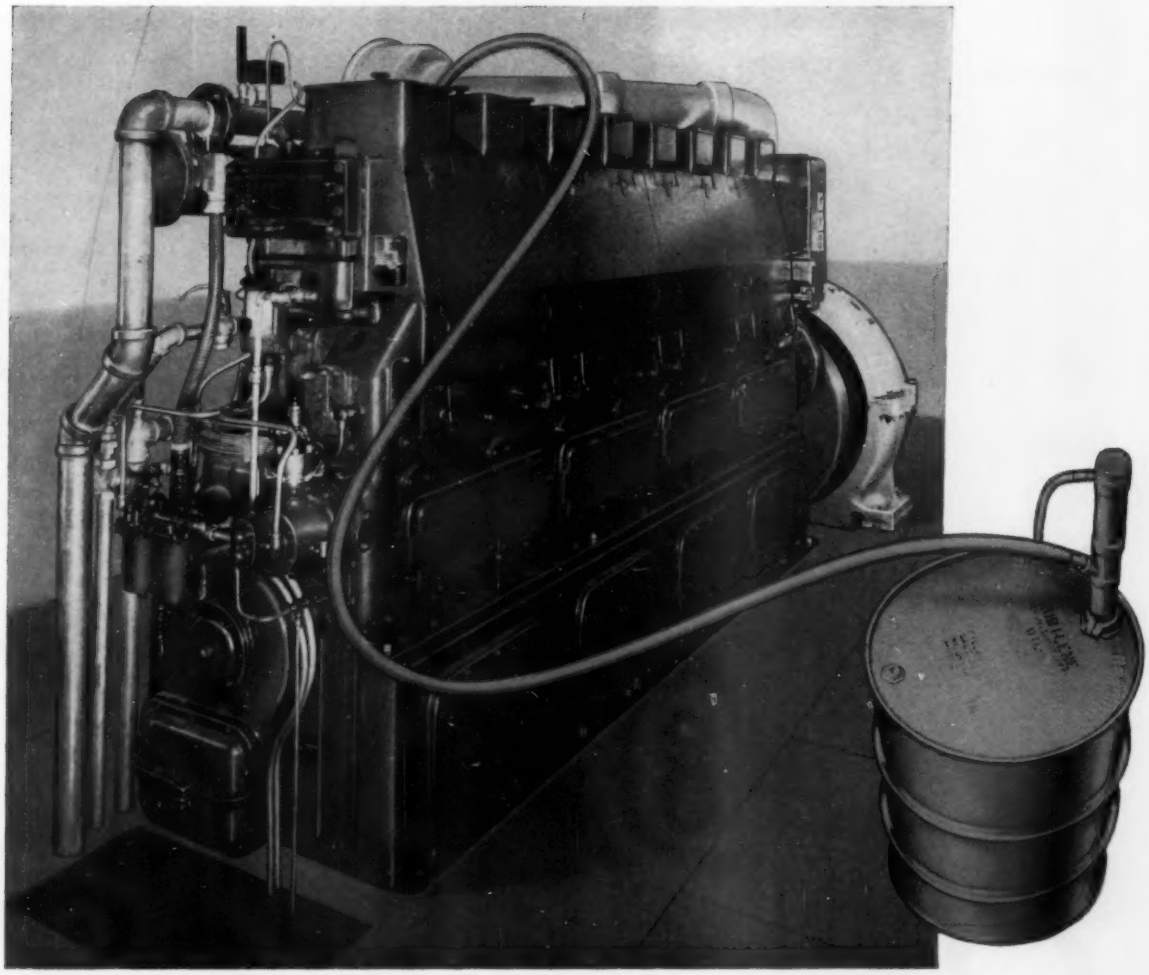

Stops Thin-Out!

You can protect your Diesel against wear due to excessive thin-out of the lubricating oil at higher operating temperatures. Switch to Sinclair RUBILENE®, *the high viscosity index oil* proved by over 35 years in a wide variety of Diesel applications. You'll find RUBILENE holds its high film strength and reduces oil consumption . . . gives you better protection of cylinders, pistons, rings and other vital moving parts operating continuously for long periods. Your Diesel logs more full-power hours!

Switch now to RUBILENE. Regardless of the make of your Diesel, there's a member of Sinclair's famous RUBILENE or RUBILENE HD family that meets your needs exactly! Call your local Sinclair Representative or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation!*

SINCLAIR

RUBILENE OILS

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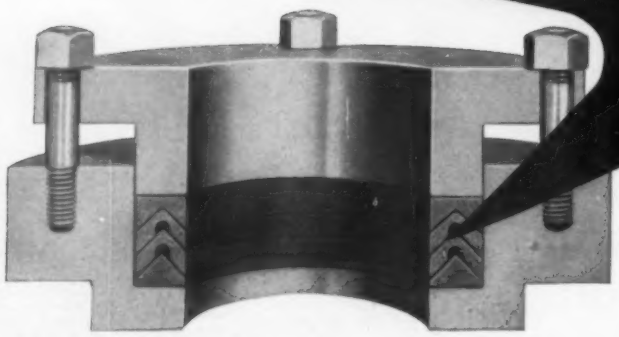
ONE OF THE GARLOCK 2,000

SHALLOW STUFFING BOXES NEED THIS KIND OF "GRIP"



GARLOCK 431 CHEVRON* PACKING

for use on reciprocating rods and rams, tightens as pressure increases, eases off as pressure decreases, assuring no-leak sealing and minimum friction.

LOOK AT THESE SERVICE REPORTS:

- On hydraulic press with 40" dia. ram, operating at 6000 psi pressure, .006" clearance between ram and gland, GARLOCK 431 CHEVRON size 40" x 41½" by only 2" deep gave 14 years service.
- On hydraulically operated clutches with ¾" cylinder, 500 psi pressure, ¾" travel, operating intermittently. Neither leather cups nor "O" rings worked well. Now packed with GARLOCK 431 CHEVRON ⅜" x ¾" x 17/32" deep. Result: smooth, positive sealing.

And remember, 431 CHEVRON Hydraulic Packing is only one of "the famous GARLOCK 2,000" . . . two thousand different styles of packings, gaskets, and seals to meet *all* your needs. It's the *only* complete line . . . it's one reason you get unbiased recommendations from your GARLOCK representative. Call him today or write for Folder AD-115.

**Registered Trademark*

THE GARLOCK PACKING COMPANY, Palmyra, New York

For Prompt Service, *contact one of our 30 sales offices and warehouses throughout the U.S. and Canada.*

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

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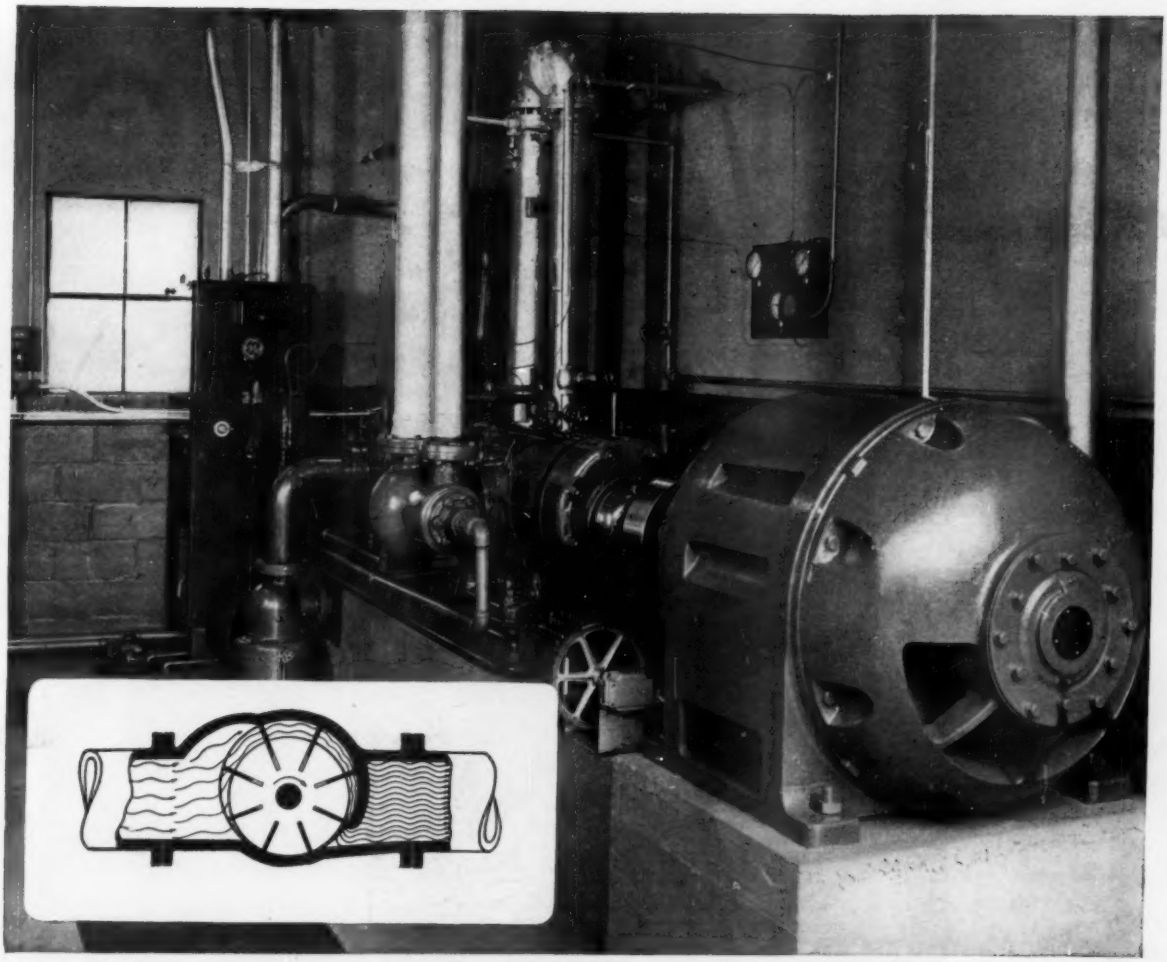

TWICE THE CAPACITY

of a Comparable Duplex Horizontal-belted Reciprocating Compressor

The Fuller Rotary serves best when you require additional compressed air, and available space for a compressor is limited.

It has twice the capacity of a comparable duplex horizontal-belted reciprocating unit, is singularly lacking in vibration, and requires only a nominal foundation to support its weight.

Operating at normal speeds, the Fuller Rotary Compressor is direct-connected and needs no cumbersome reduction gearing or belts. You can put a Fuller Rotary in almost any unused corner, or on a balcony, or (in reasonable size) even suspend it from the rafters.

Normal industrial pressure to 125 psig; capacities to 3300 cfm. Detailed information on design characteristics and typical space-saving applications will be forwarded on request.

Fuller

. . . . pioneers in harnessing AIR

FULLER COMPANY, 150 Bridge St.
Catasaugua, Pa.

GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY

Chicago • San Francisco • Los Angeles • Seattle • Birmingham

C-270
1555

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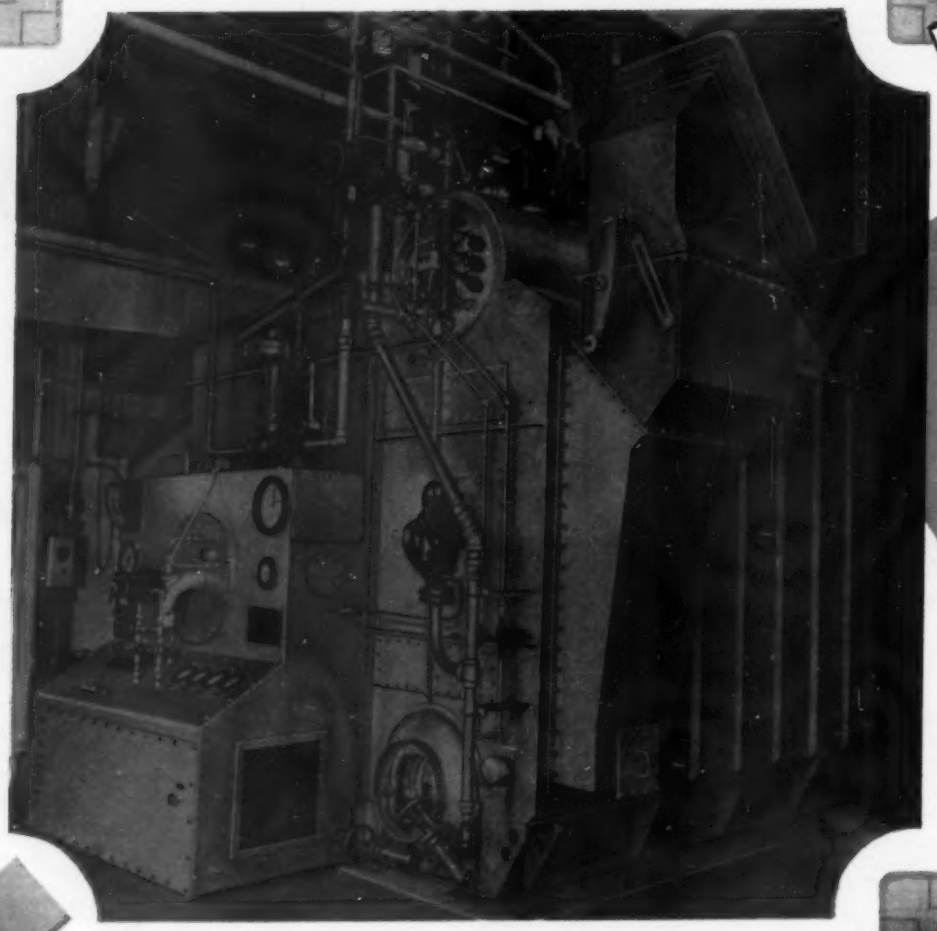
"You can't get a Better

Says Stanley D. Loomis, Chief Engineer of The United Piece Dye Works, a leader in the field of textile dyeing, finishing and printing. Of course, he's referring to the C-E Package Boiler, Type VP – installed in the newest and most modern United Piece Dye Mill at Charleston, South Carolina.

let's look at the box score for 1955 —



Boiler Box Score"

SCORE CARD

AT BAT 3 shifts a day, 6 days a week without a single unscheduled outage.

RUNS around the clock with a quick response to load change and an ability to sustain a high overload capacity while producing high quality steam.

HITS the performance mark. C-E's prompt service and complete cooperation matches the quality of the boiler.

PUT OUTS of maintenance and repair bills are assured by the boiler's conservative design and built-in advantages. To date there have been no repair bills at all.

ASSISTS in the continued full-production operation of the plant by meeting every steam need unfailingly.

Need a Package Boiler? See C-E! You can't get a better boiler box score.

B-911

COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

STEAM GENERATING UNITS • NUCLEAR REACTORS • PAPER MILL EQUIPMENT • PULVERIZERS
FLASH DRYING SYSTEMS • PRESSURE VESSELS
HOME HEATING AND COOLING UNITS • DOMESTIC WATER HEATERS • SOIL PIPE

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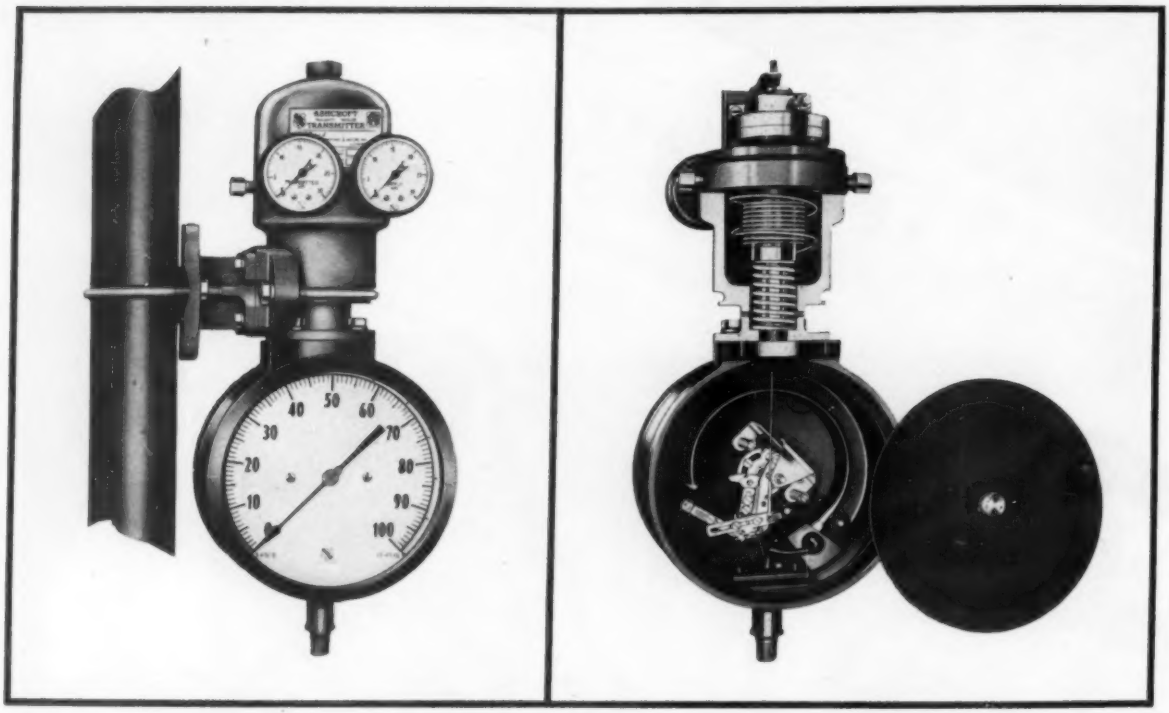
Designed to solve safety and service problems

...THE NEW ASHCROFT PNEUMATIC PRESSURE TRANSMITTER



This new Ashcroft Pneumatic Pressure Transmitter is particularly recommended to processing industries and power stations. It combines speed and accuracy with maximum protection and serviceability.

The new design features the 6" indicating Ashcroft Maxisafe Duragauge, long known for dependable performance. It has an integrally-cast solid metal wall between dial and pressure sensitive element so that the transmitter can measure pressures up to 100,000 psi with complete safety for personnel and equipment. If misapplication ruptures the Bourdon tube, the Teflon-coated back cover serves as a safety blowout relief.

Another outstanding design advantage is easy access to both gauge and transmitter sections. Simply remove the safety-relief back cover and both the gauge and transmitter can be calibrated. Yet a sealed housing makes the entire assembly weatherproof.

The transmitter operates on low-pressure air. No need for expensive high-pressure lines and fittings. Supply air pressure as low as 18-20 psi for 3 to 15 psi output provides especially advantageous operation where electrical wiring might be a hazard. Inflammable, poisonous or corrosive liquids or gases are confined close to their source, away from the central control point.

The Series 1250 Ashcroft Pneumatic Pressure Transmitter is available with pressure sensing elements in all standard pressure ranges and Bourdon tube materials. Installation of the transmitter is easy. Small diameter tubing may be used, and the pipe, stem, wall or flush mounts are interchangeable in the field. Get complete operational data and construction details. Write for Bulletin 340.

1850 ASHCROFT U.S.A.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR has the broad knowledge and thorough experience essential to satisfy every requirement of your Ashcroft Pneumatic Pressure Transmitter application. You get fast, economical service from his local stocks.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

MANNING MAXWELL & MOORE M&M TRADE MARK

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Oklahoma.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

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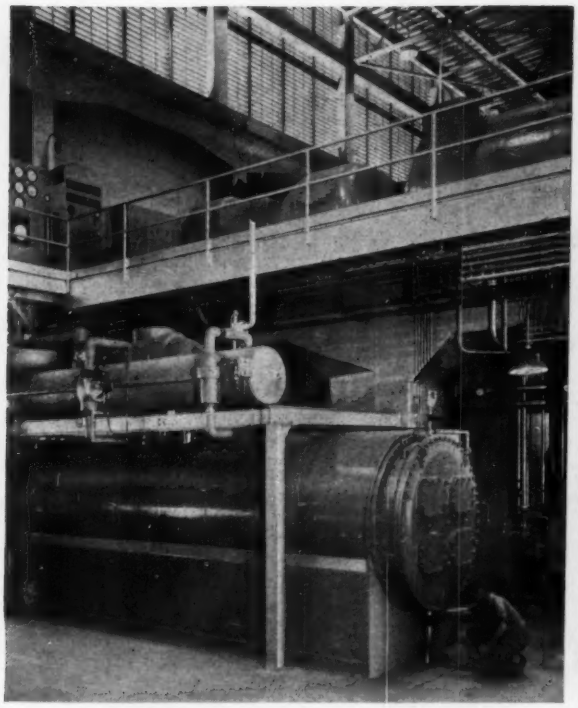
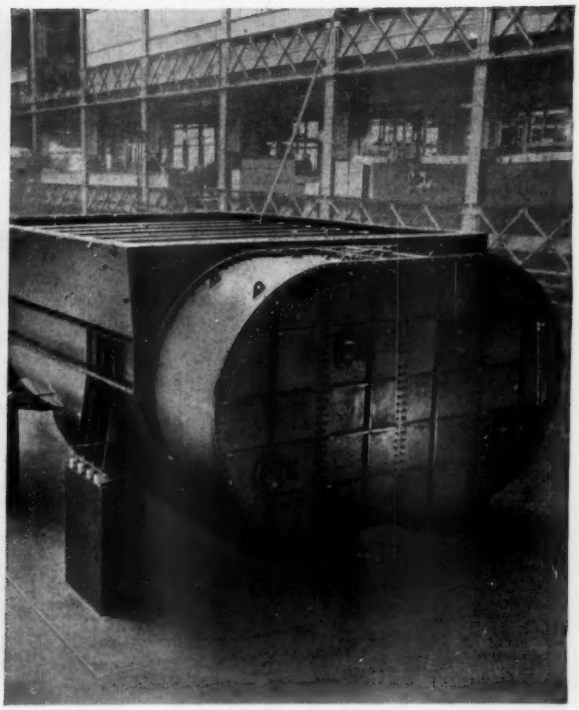


One of 28 Worthington condensers serving 20,000 kw turbine generator units in a southern aluminum plant. Each unit has twin 9300 sq. ft. shells, tee-connected.



100,000 sq. ft. low-headroom oval-type Worthington condenser. One of five units serving 215,000 kw turbine generators at the largest power plant in Ohio.

Name the job... Name the space... WORTHINGTON has the condenser!

Worthington builds condensers in all sizes to meet any reasonable space requirement. A design exclusive... the Double Folded Tube Layer... enables Worthington to "tailor" a condenser to available space, reducing cost of foundation and building construction. Most headroom limitations are easily met. The Double Folded Tube Layer design is adaptable to almost any shape of condenser shell, without sacrificing efficient performance. Worthington offers a variety of arrangements including oval or rectangular single shell units, side mounted shells with exhaust elbow, twin shells with side or tee-piece exhaust connections, and special designs for "axial-flow" exhaust turbines. Worthington can meet your needs quickly and economically.

Contact your nearest Worthington District Office or write: Worthington Corporation, A&SP-Steam Power, Harrison, N. J.

WORTHINGTON

STEAM-JET EJECTORS • VACUUM PUMPS • BOILER FEED PUMPS • FEEDWATER DEAERATORS • SURFACE CONDENSERS and AUXILIARIES • STEAM TURBINES

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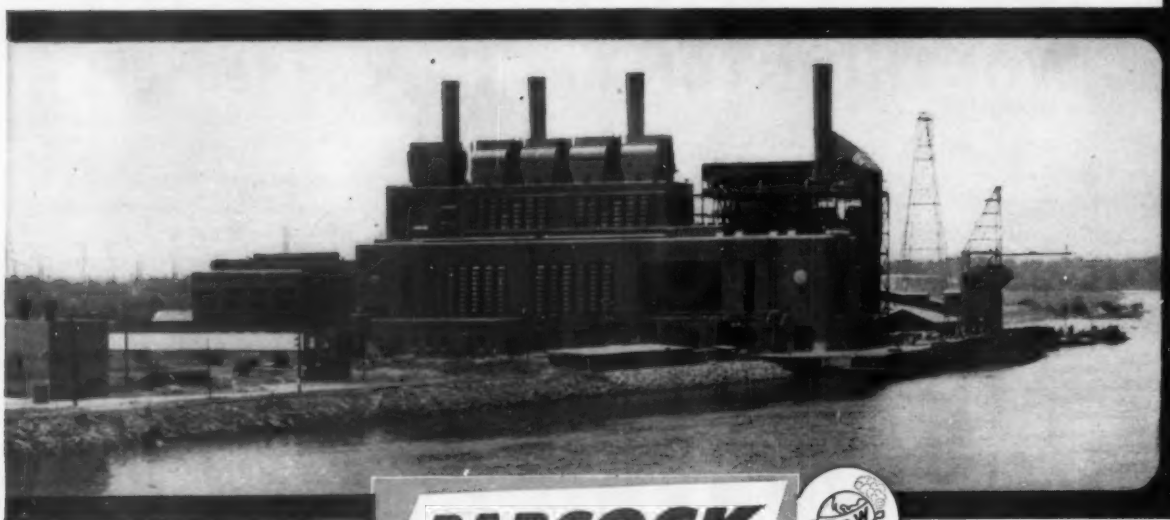
Modern Central Stations Serving America

NEW B&W RADIANT BOILER FOR

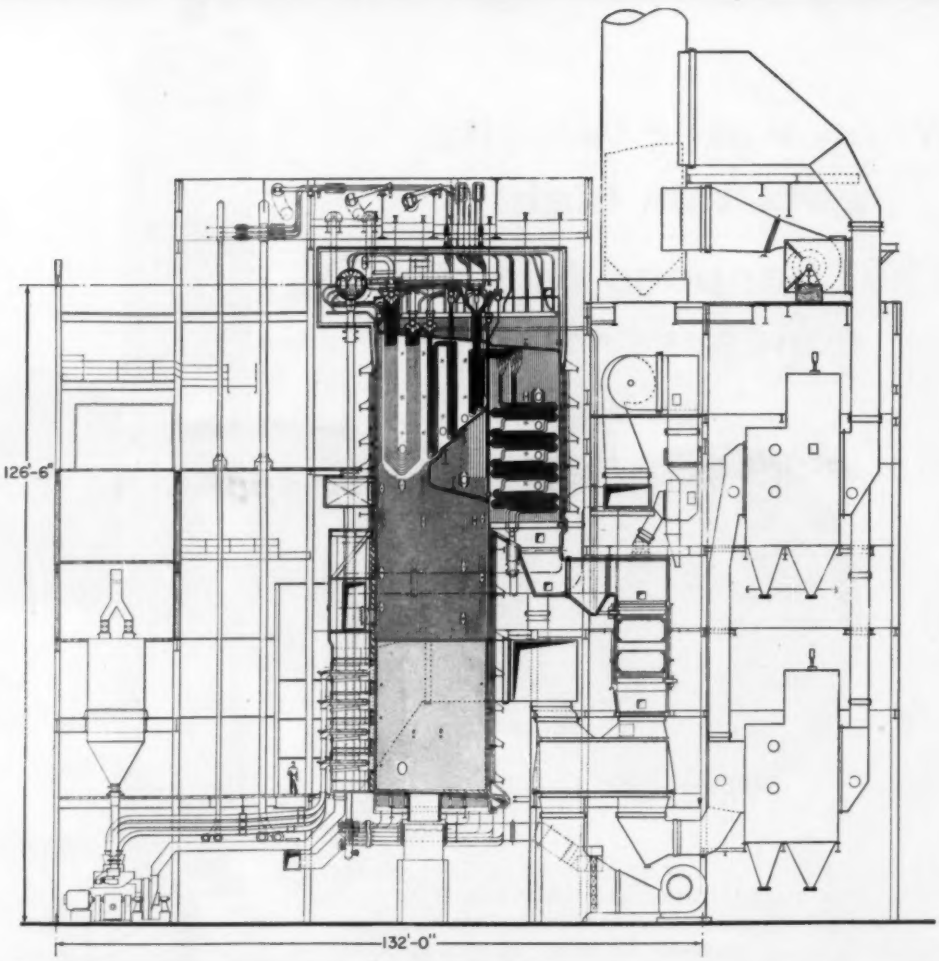
BURLINGTON GENERATING STATION

OF PUBLIC SERVICE ELECTRIC AND GAS COMPANY



BABCOCK & WILCOX

BOILER DIVISION



Supported by sound, practical engineering, Public Service Electric and Gas Company is engaged in a continuing, progressive policy of planning and over-all expansion to provide abundant, economical electricity to its large body of customers.

As part of this far-sighted program, Public Service Electric and Gas Company has installed a new, highly efficient 185,000 KW unit at its Burlington Generating Station. A B&W Radiant Boiler, generating over 1,225,000 pounds of steam per hour, contributes to the high level of performance of this new installation. The boiler is pulverized-coal-fired with provision for oil-firing, and is served by five B&W pulverizers. It is designed with divided furnace construction, gas recirculation, pressure firing and natural circulation. Unit design pressure is high—2700 psi, and the temperature is 1100 F at the superheater outlet with reheat to 1050 F.

Modern, efficient B&W steam generators, such as the latest unit at Burlington, are the results of long experience in designing, fabricating, erecting and servicing central station boilers of all types. Reinforcing this experience is an unending program of B&W research and development aimed intensively toward achieving still higher efficiency levels in the future.

The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y. G-753

When water velocity gets this high

what happens to your condenser tubes?

Any condenser tube alloy for sea-water use must be capable of forming a protective film on its surface as a barrier against corrosion. If the water velocity is low, copper-base alloys usually can form this film. But where velocities are high, as is often necessary for today's stepped-up power needs, impingement of rapidly moving sea water can remove the protective film. The result is impingement corrosion and eventual tube failure.

That's why it's important today, more than ever before, to specify the right copper-base tube alloys for your operating conditions.

For example: *where water velocities are high, many installations have shown that Bridgeport Aluminum Brass 54 has given good performance where inlet-end or impingement corrosion have been serious problems.*

When retubing existing condensers or designing new equipment, be sure to use Bridgeport's Technical Service. You'll get the benefit of our 60 years' experience in manufacturing condenser tubes to meet many different operating conditions. Call your nearest Bridgeport Sales Office today.

Write today for your copy of "How Copper-Base Alloys Have Reduced Condenser Tube Corrosion in Marine Service" by C. L. Bulow, Chief Metallurgist, Bridgeport Brass Company. Reprinted from Marine Engineering.

Bridgeport BRASS CO.

BRIDGEPORT CONDENSER TUBES

Bridgeport Brass Company, Bridgeport 2, Conn. • Offices in Principal Cities

In Canada: Noranda Copper and Brass, Limited, Montreal

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70 Years ago we used ads like this to tell buyers about Bell & Zoller Coal. We've done a lot of growing—and made a lot of changes since then. • But one thing hasn't changed—the famous free-burning, low ash, high heat-producing quality of Bell & Zoller products. • The proudest statement we can make on our 70th Anniversary is the same one we could make in 1886: Superb Quality Coal, We Mine It—ZEIGLER, MOSS HILL, ORIOLE, MURDOCK, LIBERTY SMOKELESS, BUCKHORN, SPARTA... and you can get it today through your nearest Bell & Zoller office.

Now serving 32 states from coast to coast

Bell & Zoller Coal Company

70 YEARS OF SERVICE TO COAL USERS

BELL BUILDING, CHICAGO 1, ILLINOIS

Detroit • New York • St. Louis • Minneapolis
Omaha • Milwaukee • Louisville • Washington, D.C.
Terre Haute, Ind. • Mount Hope, W.Va.

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CONSTRUCTION NEWS

Los Angeles, Calif. — The Department of Water and Power of the City of Los Angeles, Calif., has disposed of a bond issue of $24,000,000, proceeds to be used for construction program in 1956. Department has work already under way on construction of two new steam-electric generating units, each with a capacity of 156,000-kw at El Segundo generating station, to be completed and in operation by late 1959. Other work to increase power substations, transmission lines and other facilities will also be placed under way.

Los Angeles, Calif. — The Southern California Edison Co., 601 W. Fifth St., has arranged for fund of $30,600,000 through sale of cumulative preferred stock, proceeds to be used in connection with 1956 expansion and improvement program, and the retirement of short-term bank loans incurred by previous construction. Utility plans expenditure of $251,000,000 on plant additions alone, through 1956–1957. $88,000,000 will be devoted to new electric generating facilities with another amount of $40,000,000 to go for new and improved hydro-electric facilities.

St. Petersburg, Fla. — The Florida Power Corp., 101 S. Fifth St., is arranging a construction budget for 1956 in the amount of $33,000,000. Company plans to finance most of this sum through sale of Florida Power bonds in the amount of $20,000,000 and bonds against its subsidiary, The Georgia Power & Light Co., in the amount of $2,000,000. Company plans to add to present generating capacity of 510,828 kilowatts when 70,000-kw turbine generator is placed in service in November of this year. Another generating unit with an initial capacity of 120,000-kw is now under consideration for the rapidly growing St. Petersburg area.

Tampa, Fla. — The Tampa Electric Co., Cass & Tampa Sts., has announced plans to spend a record $13,000,000 on new construction this year. The 1956 budget includes funds for a third power generating plant with a 120,000-kw steam-electric generating unit, expected to be placed in service by mid-1957. Transmission lines will be part of major expansion to facilitate deliveries of power and electricity to commercial users in the territory.

Atlanta, Ga. — The Georgia Power Co., Electric and Gas Building, has plans under consideration for the construction of a 60,000 kw hydroelectric generating plant and dam on the Chattahoochee River north of Columbus to be named the James McCoy Oliver Dam. Plans call for powerhouse with four generators in place of three previously scheduled for this operation. New project will give company three plants in the Chattahoochee region with a combined capacity of 92,000 kw. Change in construction plans will increase original estimated cost from $11,000,000 to more than $13,000,000.

Indianapolis, Ind. — The Indianapolis Power & Light Co., 17 Meridan St., has approved plans for expansion at local steam-electric generating plant, to include a new turbine generator unit and accessories at South Harding Street Plant. Cost of new installation to be $14,400,000.

Louisville, Ky. — The Louisville Gas & Electric Co., 311 West Chestnut St., Louisville, Ky., has plans maturing for expansion in local generating station, including installation of a third steam-electric generating unit of 125,000-kw capacity. Project is planned for Cane Run Plant and is scheduled to be in operation by early 1958. Expansion will represent an investment of $17,500,000.

Jackson, Mich. — The Consumers Power Co. has arranged for a record budget of $89,000,000 for new construction and plant modernization during 1956. Company plans to spend $62,000,000 on new electric generating and distributing facilities to raise power producing capacity of its statewide system in excess of 2,000,000 kilowatts to provide for an anticipated increase of 30,000 new consumers next year.

Grand Rapids, Minn. — The Minnesota Power & Light Co., 30 W. Superior St., Duluth, Minn., has authorized plans for the construction of new steam-electric generating plant on 217-acre tract of land acquired for the purpose. Installation will include a 65,000-kw turbine generator unit, high pressure boiler and auxiliary equipment. Plant will be ready for service in 1957 at a reported cost exceeding $12,000,000.

New York, N. Y. — American Gas & Electric Co., 30 Church St., has announced what is believed to be the largest five-year expansion program ever undertaken by any private electric utility and has plans to spend $700,000,000 for construction and installation of new facilities through 1960. Company plans to add 2,600,000 kilowatts of new power to boost total generating capacity to more than 6,500,000 kilowatts by 1960. Much of the new construction is already under way for subsidiary companies as previously reported in these columns. A substantial amount is planned for new electric transmission lines, substations and service centers.

Rochester, N. Y.: Correction Note — In the January 1956 issue, page 36, it was stated that Rochester Gas & Electric Corp., 89 East Ave., subsidiary of General Public Utilities Corp., New York, N. Y., has arranged for financing — and so on. In this connection, we are now informed that Rochester Gas and Electric Corp is not a subsidiary of General Public Utilities Corp. and has not been a subsidiary of General Public Utilities since September 1949. It is true that the company has a construction program which is expected to require the expenditure of approximately $100,000,000 during the next five years. It is not correct, however, that the financing of this program has been arranged. It will be financed only as the actual expenditures are made from year to year during the period. In other words, the financing of the next $100,000,000 for construction is expected to be effected in a manner similar to the financing required for the previous $100,000,000 invested in plant.

Cleveland, Ohio — The Cleveland Electric Illuminating Co., the Illuminating Building, Cleveland, Ohio, has approved plans for far flung extensions, improvements and expansions to company's generating facilities through 1956, with an estimated outlay of better than $200,000,000 through 1960. Increase in generating capacity from 1959 through 1965 will also be increased over that period by 1,100,000 kilowatts. When new plant at Avon Lake, Ohio, is completed company generating capacity will exceed 2,000,000 kilowatts.

Portland, Ore. — Pacific Power & Light Co. has announced application to the Federal Power Commission for permission to construct a 256,000-kw hydro-electric generating station on the Lewis River just north of here. Company plans to start construction in the spring of the year with completion scheduled for late 1958. The hydro-expansion, known as the Swift Project, will have two power plants and will represent an investment of $58,000,000.

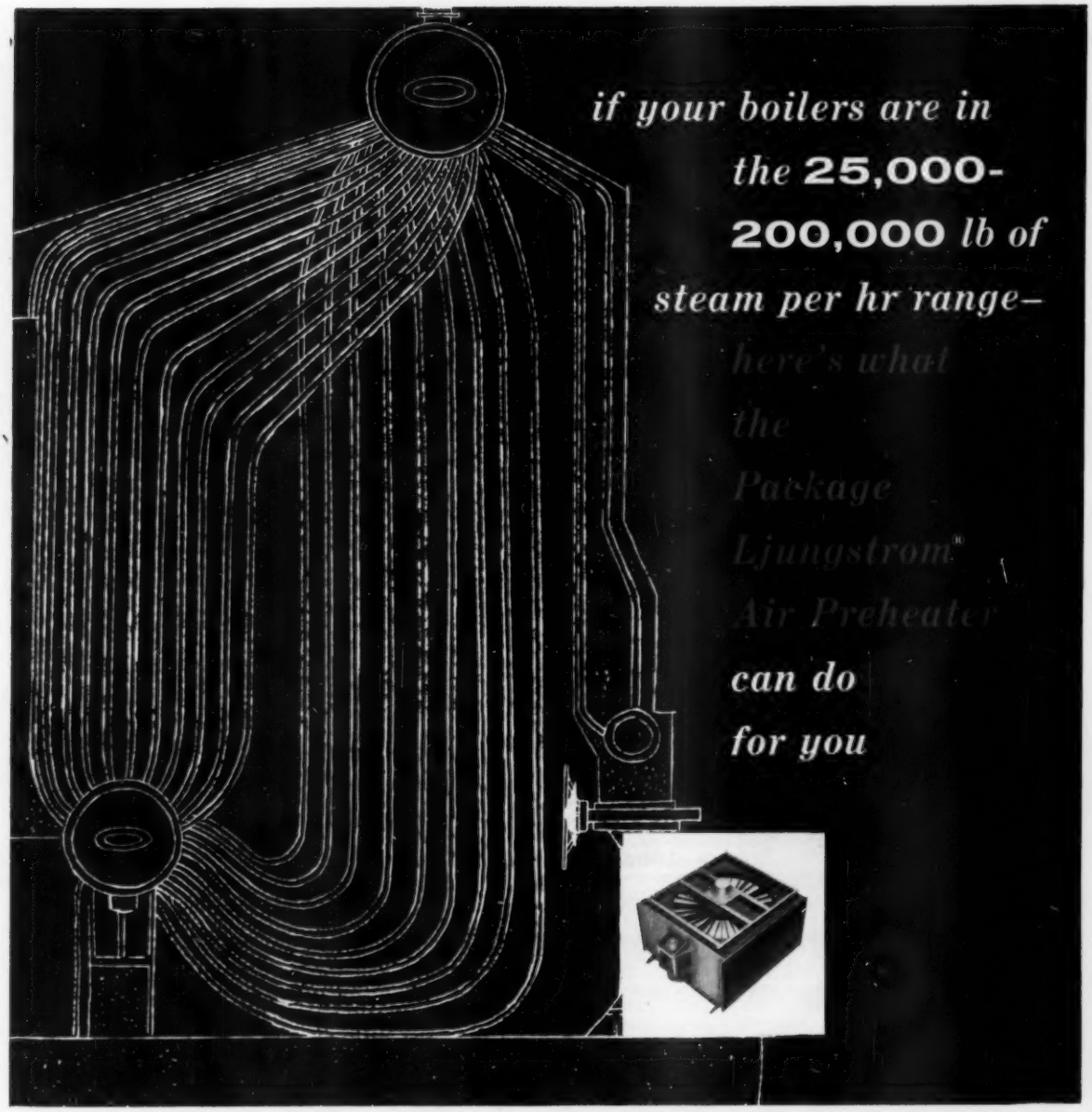
Irmo, S. C. — The South Carolina Electric & Gas Co., 328 Main St., Columbia, S. C., has plans under consideration for the construction of a new steam-electric generating plant near here, where site near company's hydro-electric facilities has been selected. Project to include generating unit, power substations, transmission lines and other plant construction is reported to cost $19,000,000. Gilbert Associates Inc., 61 Broadway, New York 6, N. Y., is consulting engineer.

Memphis, Tenn. — The City of Memphis, in line with work already under way on city's new steam electric generating plant, has awarded a contract to Babcock & Wilcox Co., New York, N. Y., for the construction of three huge boiler installations, at a cost of $24,500,000. Work consists of steam boilers and steel framework for new $135,000,000 municipal power plant under supervision of Memphis Light, Gas and Water Commission. New boilers will be equal in height to a twelve-story building and are being installed to operate 250,000 kw generators, previously announced in these columns.

Richmond, Va. — The Virginia Electric & Power Co. has approved a construction budget for 1956 in excess of $50,000,000. Biggest expenditure in the construction program for the year will be an amount of $28,000,000 for new electric transmission and distribution facilities. $13,000,000 has been set aside for new generating facilities, and the balance for company storerooms, power substations and other operating facilities.

Fort Worth, Tex. — The Texas Electric Service Co., Seventh and Lamar Sts., has disposed of a bond issue of $10,000,000, proceeds to be used primarily on new construction for 1956, including generating facilities, power substations, transmission lines.

Houston, Tex. — The Houston Lighting & Power Co., Fannin and Walker Sts., Houston, Tex., has announced plans for the erection of a new steam-electric generating plant in Fort Bend County, on site selected for the purpose, 27 miles southwest of here. Initial installation will have a capacity of 165,000-kw but ultimate projected capacity is planned to exceed 1,000,000 kw. Construction is expected to get under way soon with initial operation planned for the spring of 1958 Natural gas will be used as a source of power for the steam generating units. Cost of project not announced.



The completely shop-assembled Package Ljungstrom Air Preheater brings to medium-size industrial boilers the same principles of heat recovery used universally by large electric utility boilers. And here's what heat recovery with a Ljungstrom can mean to you:

1. **You'll save fuel** – savings of 10% or more can generally be anticipated–which means you can usually write off the cost of the Ljungstrom in about two years.

2. **Boiler output increases** – in lieu of fuel savings, by preheating air, you get higher temperatures in the boiler furnace – which means higher heat absorption, higher steam-producing capacity.

3. **Lower boiler maintenance** – preheat means more efficient combustion of fuel – therefore, there's less slagging and boilers stay in service longer between overhauls. Stack gases are cleaner, too, which helps reduce smoke nuisance and stack maintenance.

4. **Makes low grade fuels practical** – since air preheat means higher furnaee temperatures, it means, too, that low-grade fuels can be burned effectively.

If you'd like more details on how the Package Ljungstrom Air Preheater can improve the efficiency of your boiler plant – write the Air Preheater Corporation. Our field engineers will be glad to make practical suggestions.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.

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EQUIPMENT NEWS

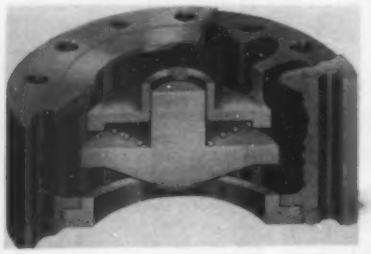
Described on these pages are new and improved products. Use Reader Service Cards on pages 113–114 to ask for more information on them. Just circle the item numbers of all the products in which you are interested.

1—RUST PREVENTIVE to spray on tools, instruments, parts

Rust Chek is packaged in a 12-oz aerosol spray container. According to manufacturer, a can provides about 80 sq ft of coverage in the form of a clear, dry, waxy film to a thickness of 0.0005 in. Except in the case of use on precision instruments where critical tolerances must be held, the film need not be removed when the tool, machine or part is removed from storage and readied for use. The film is worked off in the using, it is explained, and in some applications, it serves as a lubricant. Besides its ease of application, Rust Chek is claimed not to absorb dust and dirt. Eastern Aerosol Products.

2—SILENT CHECK VALVE for control of water hammer

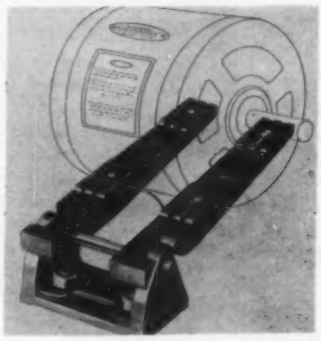
This simplified flanged silent check valve, the Williams-Hager Figure 454, is suggested for control of water hammer for all types of hot or cold liquid service



— including water, oils, gasoline, acids, chemicals, salt water, brine — where flow is constant. The unit has been developed to provide a lower cost valve without sacrificing water hammer control and durability features, company states. It is available in sizes from 1 to 10 in., faced and drilled in accordance with ASA standard for pressures from 125 to 2500 lb. The valve can be furnished with special flange facings. The Williams Gauge Co., Inc.

3—MOTOR BASE, for V-belt drives, maintains belt tension

Described as inexpensive and requiring no maintenance, the Auto-Tension Motor Base is designed to automatically compensate for belt stress and maintain exact belt tension for all load conditions. The greater the load the greater the belt tension, says manufacturer, and this substantially reduces wear on both belts and bearings. Operation is quiet with this base, it is reported, and belts can be changed without disturbing the mounting. The base comes in four NEMA motor frame sizes from ⅛ to 7½ hp. It is designed for use with horizontally positioned drives — is not for use on wall or ceiling mountings. Bulletin 1300 gives details. Lovejoy Flexible Coupling Co.



4—ALL-PURPOSE LUBE offers economy, other advantages

Primaleen can be applied up to 90 times less frequently than most greases, says manufacturer, and its tenacity and ability to fill the pores of the surface lubricated make it outstanding in reducing friction at high pressures, high sliding velocities and close tolerances. Possessing thixotropic characteristics, it will not drip even when afire, it is claimed; and it resists water, chemical vapors, and temperature changes. Primaleen is suggested for conveyors, bearings, slides, gaskets, packings, gears, shafts, valves and stems, others. Other benefits cited for this lubricant include protection against rust resulting from soluble oils; no crystallization and no flaking at –30 F. Open cup flash point is given as 355 F. Protecto-Lube Co.

5—EPOXY COATINGS will coat at low temperatures

All-Coat Epoxy Coatings are based on the use of catalysts to provide, in an air-dry system, the properties generally obtainable only with high-temperature baking. This permits coating of items too large or otherwise impractical to bake, such as chemical process equipment, water towers and tanks. These coatings are said to cure at temperatures as low as 40 F. Tests are reported to show that they have excellent adhesion, abrasion resistance, toughness, flexibility, resistance to acids, alkalies, solvents. Shutt Process Equipment Co.

6—PROPELLLER FANS with low noise level operation

The Type QD Direct-Connected Axial Flow Fans are designed for large air moving applications requiring low noise level operation. Fans are available in six sizes from 12 through 36 in., with air delivery ratings to 12,000 cfm. A cast aluminum airfoil propeller operating at low speed accounts for quiet operation. Rigid and non-corrosive, propeller will operate continuously without danger of bending, says company, and the thick airfoil design of propeller also eliminates sounding board effect. Also, venturi design of the mounting ring prevents air recirculation at propeller tips, thus reducing noise further. And because propeller is directly connected to motor, belt noise and horsepower loss from pulley friction are claimed to be eliminated. Fans are powered by totally-enclosed, continuous duty, 115 230-v, permanent split capacitor motors. Fans are adapted for two-speed operation as well as variable speed operation with Propellair controllers. Wall shutters and wire mesh guards are available. Propellair Div., Robbins & Myers, Inc.

7—INSERT RINGS improve welding of piping and tubing

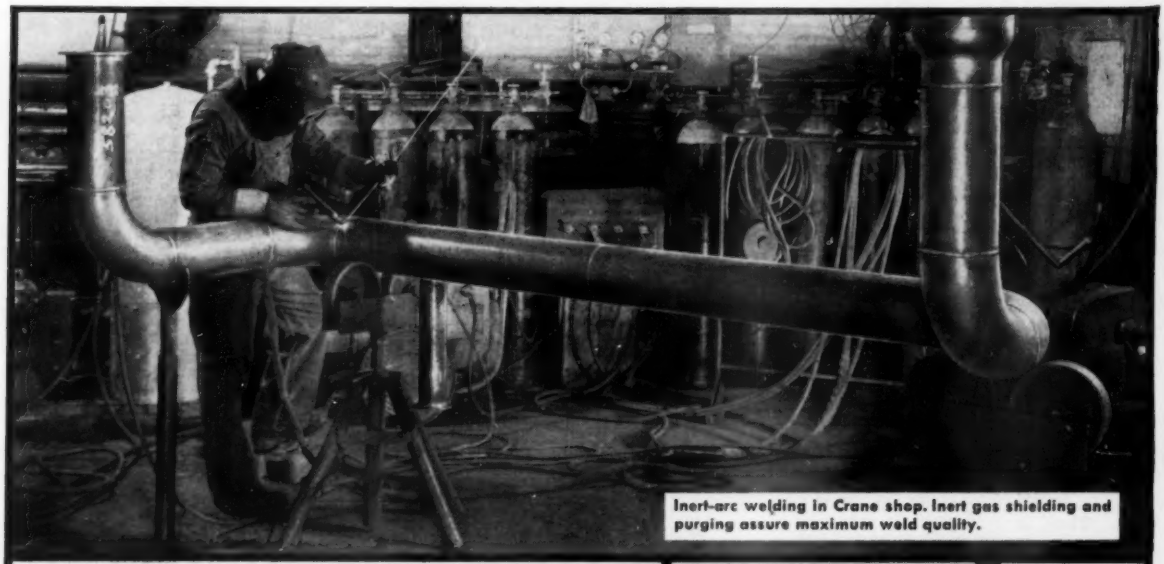
Consumable solid insert rings are announced as offering several benefits — inert-gas tungsten-arc welding of piping without backing rings, smoother root pass welds with elimination of root pass cracking and improved weld contours in thin wall piping with one or two fewer passes. On piping of wall thickness over ¼ in., the insert ring assists in obtaining root pass welds of uniform and smooth contours, free of crater and center-line

cracks, it is noted, and the completed root pass weld provides an effective back-up for subsequent shielded metal-arc welding with covered electrodes.

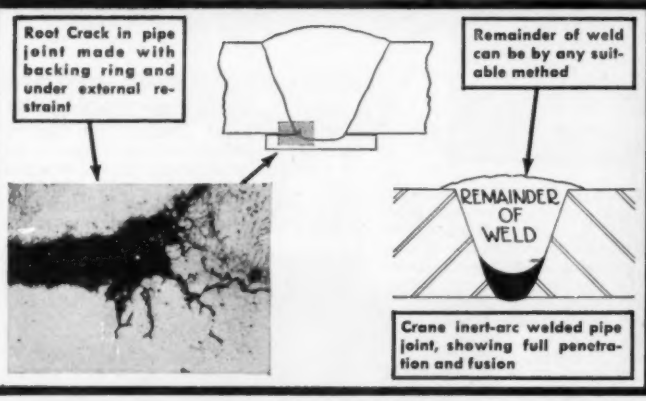
On thin-wall piping, as Schedule 5 and 10 stainless steel, the insert ring is claimed to improve weld contour. On many sizes, it also eliminates need for separately supplied filler metal and necessity for one or two additional weld passes, says company, and this reduces welding costs. The consumable solid insert rings are produced for standard and special pipe and tube sizes of 1½-in. diam or larger in mild steel, several alloy and stainless steels. Industrial Piping Division, Grinnell Co., Inc.

8—AIR-METER assists in smog control studies

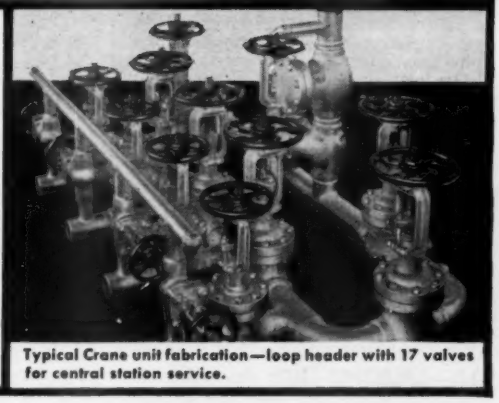
The Model R Air-Meter is designed for use in connection with smog, air pollution, and other applications where extremely small air flow measurements are necessary. With a range of 0-30 mph, and a logarithmic type meter scale which provides expanded readings in the low



Inert-arc welding in Crane shop. Inert gas shielding and purging assure maximum weld quality.


Root Crack in pipe joint made with backing ring and under external restraint
Remainder of weld can be by any suitable method
REMAINDER OF WELD

Crane inert-arc welded pipe joint, showing full penetration and fusion



Typical Crane unit fabrication—loop header with 17 valves for central station service.

Crane-developed butt-welding technique assures more efficient power piping

Gives important advantages—eliminates backing rings

On shop fabricated assemblies, Crane inert-arc *first pass* welded butt joints are making significant contributions to modern power plant operation.

By eliminating backing rings as used with metal-arc welding, the Crane inert-arc first pass technique assures a high quality weld with smooth root contour without crevices. It eliminates the possibility of basal cracks sometimes associated with backing rings or the characteristics of the base material.

The practicability and dependability of Crane inert-arc *first pass* welding have been thoroughly demonstrated. Leading power plants have been enjoying its advantages for several years, particularly on heavy wall alloy piping for main steam service, and on Schedule 160 carbon steel boiler feed piping.

Welding all types of heavy wall alloy power piping is just one of Crane's services to the power industry. Crane handles every phase of unit fabrication for headers, assemblies and valve groupings—simple or complex, large or small. See your Crane Representative for expert assistance on all power piping needs. Write to address below.

CRANE VALVES & FITTINGS

PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

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velocity range, the Model R is said to assure excellent readability below 5 mph and unusual accuracy below 1 mph, with response time less than 1 sec. Air velocity measuring probe, which contains no moving parts, is described as being horizontally non-directional and is suitable for portable use or fixed installation. Probe may be installed at a remote point from indicator. The instrument can be used with a recorder to obtain permanent chart records. Indicator unit measures 4½ by 4¼ by 7½ in. and operates on 90-135-v a-c, 60 cycle, with a 6-ft line cord. Battery-operated units can be supplied. Price is about $135, including probe. Catalog 139 furnishes more details on the Model R. Hastings Instrument Co., Inc.

9—FLOW INDICATOR is ball-type, having a dual scale

This ball-type Flow Indicator provides a dual scale for approximate measurement of water flow in gpm and air flow in cfm. Thus, it is explained, this inexpensive but sturdy instrument is versatile for industrial use. The indicator uses a ball on a guide rod, installed in a tapered glass tube to indicate flow in a pipe line. When fluid, water or air, flows from inlet at bottom to outlet at top, it exerts force on the free moving ball causing it to rise in the tube, higher as the rate of flow increases. Position of ball in relation to scale graduations gives an approximate indication of flow rate.

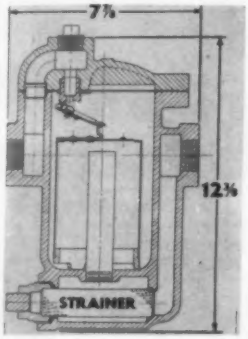
This type flow indicator is suggested for use when flow is from one direction only — bottom to top in vertical pipe lines, and when observation from any direction is desired. Made of bronze, the indicator is carried in ¼ in. to 2 in. pipe connection sizes. Details are in Bulletin 18W. Schutte and Koerting Co.

10—SPLICING KIT for branch or tap splices

Moisture-proof low voltage "branch" or "tap" splices that can be insulated in less than 10 min and used under water are reported possible with the Scotchcast Splicing Kit 90-B1. It contains single-use branch splice mold and self-mixing plaster package of "Scotchcast" electrical insulation resin No. 4. The 90-B1 makes possible complete encapsulation of splice in liquid epoxy-type resin, it is explained; the resin — a synthetic, thermosetting plastic — hardens into a durable jacket, sealing out moisture and eliminating electrical leakage. For use in application under or above ground or where moisture is a problem, the kit requires no special tools, equipment or skills according to the manufacturer, and the splice can be used even where it must function when totally immersed in water. This splicing kit can be used on cables having outside diameters of from 0.35 in. to 0.80 in. for the feeder, and can be used on splices made with all conventional connectors. The kits are sold in cartons of ten; single test kits are being made available, too. Minnesota Mining and Mfg. Co.

11—STEAM TRAP with integral strainer for catching sediment

The No. 883, announced as the largest of four cast semi-steel integral strainer steam traps made by this company, features an integral strainer which protects trap from harmful sediment, scale or other foreign particles that may be present in steam lines. Trap is designed for use at pressures to 250 psig; capacity



is 3500 to 4400 lb per hour of condensate. Side inlet, side outlet, screwed pipe connections are furnished either ¾ or 1 in. Standard screen material is stainless steel, perforated 0.045-in. diam holes, 226 to the square inch; other materials are available. Integral mechanism of trap is all stainless steel with lapped valve and seat of hardened chrome steel. Materials, workmanship and design of internal mechanism are identical to mechanisms in company's high pressure forged steel traps used for service up to 900 lb, 900 F. Integral strainer feature saves on installation labor, it is noted; it requires fewer fittings and costs less than a trap and separate strainer. Price is about $34. Armstrong Machine Co.

12—D-C POWER SUPPLY with output of 24–32 v at 100 amp

This magnetic amplifier regulated power supply is a tubeless unit containing no moving parts except a cooling fan, and is claimed unique in that it has a 3.2 kw output housed in a cabinet only 26½ in. long and 17 in. high. Identified as the Model MR2432-100XA it has a d-c output of 24-32 v at 100 amp; a-c input available either in 208, 230, or 460 v, three-phase 60-cycle. Voltage regulation is given as ± ½ per cent over complete voltage. Perkin Engineering Corp.

13—CONTROL VALVES offered for on-off service

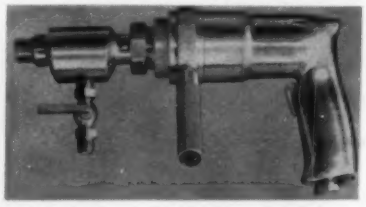
The Series 700 Control Valve is announced as a rugged small flow valve for on off service, air to close, air to open. This valve type is recommended for the following services; gas, oil, water, steam. Available in sizes ¼ to 1 in., body materials are cast bronze, cast iron, cast steel, and stainless steel. Valve is designed and engineered for long life and low maintenance, company states, and is excellent for use in chemical, petroleum, and other industries. Quick opening, either metallic or composition discs are used as standard trim. Stainless steel available if required. Working pressures are 150-300 lb as a standard, higher pressures on application. Screwed ends are standard throughout. Uniflow Valve Corp.

14—HYDRAULIC PUMPS for the heavy duty applications

The 3600 Series of 150-hp, 1500 psi hydraulic pumps, designed for heavy mobile and industrial equipment, are engineered for installations where space is limited and where adverse conditions exist. Pumps will deliver 65-90-110 gpm at 1200 rpm, depending on the model. Speeds range to 2000 rpm; pressures to 1500 psi and fluid horsepower to 150 hp. Companion control valves have also been designed for the series. The high capacity permits consideration of hydraulic operation and control for larger stationary and mobile equipment previously driven by mechanical and other methods. Hydreco Div. The New York Air Brake Co.

15—TUBE-CLEANING MOTORS are air driven units

Two new models of air-driven motors for driving shafting equipped with drills or brushes for cleaning small, straight tubes power these gun-type cleaners. They are designed for use particularly where suspension type cleaners cannot

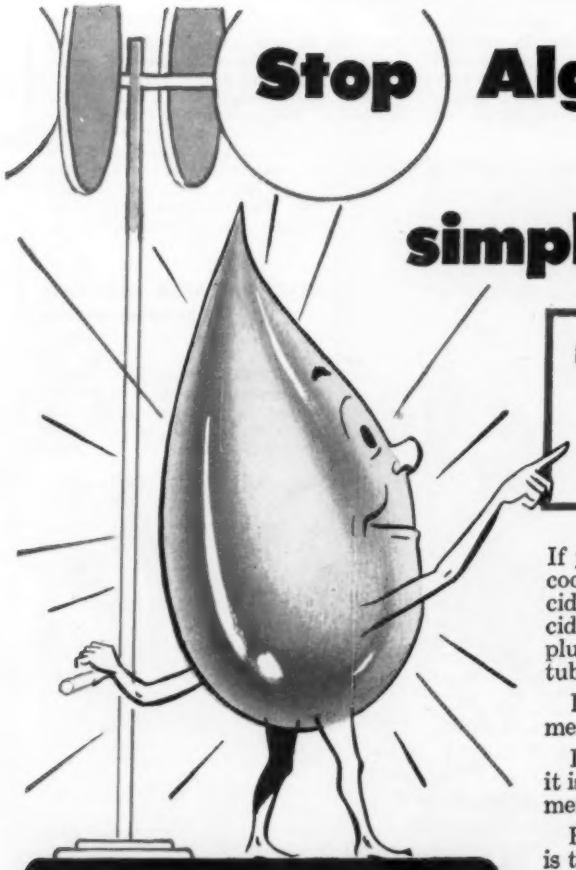


be used. They are light, but powerful, have gun grip handles with trigger valve as well as a second holding handle. The units use ⅜ in. hose with ¼ in. thread and require 15 to 20 cfm of air at 90 psig. The motors are equipped with built-in governor and oil reservoir, also with water-feed valve and non-rotating water-feeding attachment. Larger model has a side handle which can be shifted to any desirable position. On smaller model (not shown), water inlet hose connection forms a second handle. The Lagonda Div., Elliott Co.

16—WET DUST COLLECTOR permits efficient dust transfer

The Ventrijet Wet Dust Collector is said to achieve proper atomizing of water and mixing with air stream to permit efficient dust transfer by movement of air without mechanical means. Dust laden air enters and expands in the inlet chamber at reduced velocity. Heavier particles sink to the bottom of the tank as sludge, and air is drawn through one or more venturi tubes into the discharge chamber. Low pressure area in the venturi throat induces water also to enter the high velocity stream. Mixing of air and water causes transfer of dust particles from the air to the water particles.

Stop Algae Problems *NEW* simple, low-cost way



NEW Allis-Chalmers Algaecide kills all classes of algae and other microscopic organisms in cooling water

If you are troubled by slimes and algae in your cooling tower system, new No. 120 Series Algaecide is the answer. It is the most effective algaecide known. It eliminates such problems as plugged pump strainers, coated heat exchanger tubes, coated slats in cooling towers.

It is easy to introduce into the system by means of a pump, drip feed or manual feed.

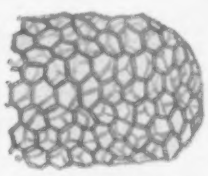
It is safe to handle. Even in concentrated form it is only a mild irritant to skin, eyes and mucous membranes.

Field tests prove that a 5-ppm concentration is toxic to most organisms.

Get complete information on No. 120 Series Algaecide. Call your nearest A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for Bulletin 28X8434.

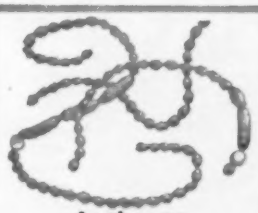
Call on **ALLIS-CHALMERS** for **Water Conditioning**

As little as 2 ppm has killed all these algae



Hydrodictyon

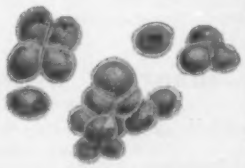
Microcystis



Anabaena

Oocystis

Chlorella



Protococcus

ALLIS-CHALMERS

A-5071

The air, water and sludge mixture impinges at high velocity on special surfaces in the discharge chamber, sludge settles to bottom of tank, and washed air then flows through an eliminator section for removal of droplets and clean air is discharged. Unit comes in capacities from about 1,000 to 30,000 cfm, and is available in single and double row tube types. Pangborn Corp.

17—CABLE REEL for storing heavy electrical cable

Cable not in use can be kept safely out of work areas and away from possible damage with the use of this cable reel. Operator need only unwind the length needed for each job. To put cable back on drum he merely presses a push button switch to start the explosion-proof electric rewind motor. Control is set up so that cable cannot be accidentally rewound while being used. Custom built for each application, reel can be mounted in cabinets or on walls and girders. An angle-iron frame anchors the reel in place, and added protection is provided by rolled edges on drum discs, and by smooth drum design to prevent scuffing and cutting. Reel is available with electric motor, or geared hand crank rewind. Clifford B. Hannay & Son, Inc.

18—MAGNETIC LEVEL sticks to the job all by itself

Having built-in permanent magnets, the Magno-Level stays right on the work, says manufacturer, leaving both hands free. The device is designed to hold securely on ferrous metals at any angle on either flat or curved surfaces, and its large, polystyrene dial permits at-a-

glance reading from any angle. Company says this level is particularly helpful on overhead or cramped quarter work, and that the Alnico permanent magnets used will not weaken on contact with metal — will hold in position indefinitely. Made of aluminum, the Magno-Level weighs only 10 oz, is 9 in. long, for use in plumbing, steam-fitting, sheet metal work, carpentry, other work. This magnetic level sells for around $10. Richards Merchandising, Inc.

19—ADJUSTABLE WRENCH offers faster action

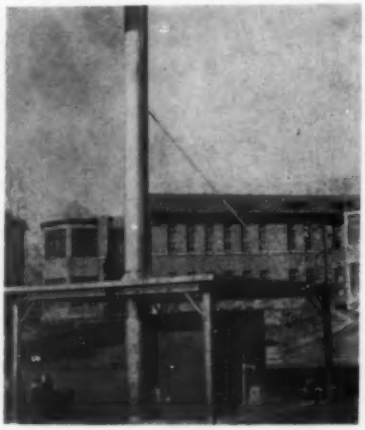
Described as a ratcheting adjustable wrench without any ratcheting device, the Handi-Spin provides faster action by allowing the wrench to remain on a hex head nut all the time while tightening or loosening the nut. Secret of the new wrench lies in its upper jaw which is designed to allow for a secure bite on the nut, yet release the bite when pushed upward. This means that a constant pumping action is possible, manufacturer states. Each time the wrench is down as far as possible, you simply push up to the top and pull down again, getting another secure bite on the nut. Despite this novel action, the wrench is said to work in every way as a regular wrench without slipping when the forward part of the jaws are used. The Tedd Co.

20—SPEED REDUCERS, for big jobs, are shaft mounted

With the addition of two models to its Torque-Arm line, this manufacturer now offers shaft-mounted speed reducers, with capacities from 1 to 60 hp and output speeds from 12 to 365 rpm, which represents an increase of 40 per cent in maximum rated horsepower capacity. The new size No. 8, in the double reduction series, extends advantages of shaft mounting, plus performance and economy features of the Torque-Arm Speed Reducers, to big jobs. The No. 8 has a capacity of 60 hp at 100 rpm, AGMA rating, and can be mounted on shafts up to five inches diameter. At the other end of the Torque-Arm line is the new No. 11, with a capacity of 1.3 hp at 100 rpm. These new sizes have the inherent advantages of the Torque-Arm line. No foundation, no flexible couplings, no sliding base is required for any of these reducers, it is pointed out and there are no lining up problems. The reducers are mounted directly on the shaft, and the Torque-Arm is fastened to any fixed object, anchoring the reducer. The unit is driven through a V-belt drive. Company's Taper-Lock Sheaves permit any speed ratio desired. Bulletin A-637 contains information. Dodge Mfg. Corp.

21—PRE-CAST STACK for venting of industrial incinerators

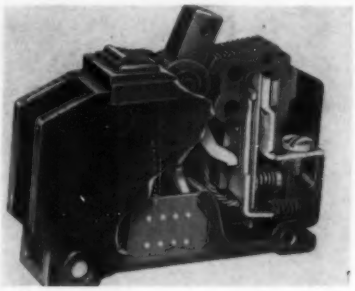
Industrial and commercial plants sometimes hesitate to install an incinerator because a low-cost, permanent high-draft chimney is not available to vent the unit. This pre-cast stack offers a solution to this problem. Because it is factory-produced, the cost of the stack is low — about ⅔ less than a comparable brick stack, says manufacturer, and about the same as a steel one. This is important, it is pointed out, because an incinerator installation may not warrant the cost of a brick stack, yet demands permanence and high draft. This stack will last about three times longer than a comparable steel stack, according to manufacturer, and the vermiculite concrete chimney sections are not affected by corrosive flue gases and can withstand temperature shocks, flame impingement and abrasive action of particles in flue gases. The refractory insulation wall serves to prevent excessive heat loss and provide high draft.



This stack is designed to handle all fuels, and can be supported on the incinerator or built up from a footing beside it. The stack is made up of 3-ft-long sections cemented one on top of the other. Each section has an aluminum outer jacket. Six sizes from 10 to 24 in. ID are available. Van-Packer Corp.

22—CIRCUIT BREAKER acts fast to protect wiring

This ambient compensated Quicklag Circuit Breaker, designed for 120-v a-c lighting and power distribution panels, acts with increased speed to protect circuit wiring, it is announced, and eliminates tripping due to ambients varying between 30 and 140 F. These



combined features result from a "ten times rating" magnetic trip for short circuit protection so 15-amp breakers will trip magnetically at 150 amp. True ambient compensation is said to be provided by a bimetal element that permits full rated load in wide temperature variation. Instantaneous circuit interruption is delayed beyond the duration of peak currents for tungsten lamps and motor starting. Other features include quick-make, quick-break action, and bolted-type connections. Breakers are supplied in 15-, 20-, 30-, 40- and 50-amp ratings. Catalog 1-150 gives more details. Federal Pacific Electric Co.

23—CONTROL VALVE for liquids, steam and gases

This redesigned version of the Cash Standard Type D Pressure Reducing and Regulating Valve is announced as incorporating two major improvements. They are: a 50 per cent reduction in number of flange bolts to save maintenance time, and the use of a gasket seal at the diaphragm flange for easier pressure range conversion. Features retained from the former model include interchangeable internal working unit; easily accessible interior; simple construction with minimum parts; and built-in strainer. The new valve comes in iron, bronze, steel or stainless steel body, and bronze, stainless steel, nitralloy or monel trim. Screwed ends are from ¼ to 2 in. Full information is in Bulletin 950. A. W. Cash Co.

24—INSULATING VARNISH is based on epoxy resins

Thermopoxy T-653-LB is a thermosetting material based on epoxy resins and electrical insulation endurance in the

ÆSOP'S FABLES No. 2

The hungry Wolf saw Mrs. Goat feeding at the top of a steep precipice, where he had no chance of reaching her. Again and again he implored her to come down where the grass was much sweeter and more abundant. Finally, she replied: "Are you certain, friend Wolf, that it is *my* supper you are so concerned with, and not your own?"

Moral:

The friend with an ulterior motive can be dangerous.

. . . we *confess* an "ulterior motive" but, a beneficial one . . . the more good companies such as yours that become aware of the "outage time" and money *saved* with superior ADAMANT Fire Brick Cement . . . or any of the popular ADAPRODUCTS Line of Refractories . . . the greater opportunity we have to be of service and fill your *every* Refractory requirement.

Our new Bonding Mortars bulletin #3 will gladly be sent upon request.

Botfield

ESTABLISHED 1907

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philadelphia 47, penna.

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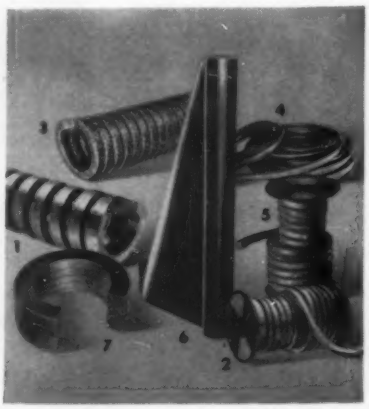
R/M's Big 7 Packing Types put an end to confusion in the stockroom

You'll lower your inventories with R/M's Big 7 and greatly reduce any chance of error through wrong selection. You'll also cut costs and downtime, and simplify ordering. For R/M's Big 7 are engineered to meet 95% of all your packing needs. You may need only 3 or 4.

You get custom-built performance when you use R/M's Big 7. Take Vee-Flex, for example, a Type 7 packing for hydraulic and pneumatic applications. This self-sealing, self-adjusting packing gives perfect performance—even at pressures in excess of 6000 psi.



Your R/M distributor has complete information on the R/M Big 7 line. Ask him to explain to you the many great advantages you can gain by standardizing on the Big 7. All R/M packings for maintenance purposes are sold only through authorized R/M distributors.

Type 1, for pumps, valves; **Type 2,** for high temperature valve stems, expansion joints; **Type 3,** for high speed rotary air compressors; **Type 4,** for corrosives, acids, viscous materials; **Type 5,** "Teflon"* for chemicals; **Type 6,** gasket materials; **Type 7,** for hydraulic and pneumatic equipment.

*Du Pont trademark

R/M'S BIG 7 PACKING TYPES MEET 95% OF ALL PACKING NEEDS

R/M **BIG 7 PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N.J.
MECHANICAL PACKINGS AND GASKET MATERIALS

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Crawfordsville, Ind.; Neenah, Wis.; Peterborough, Ontario, Canada.

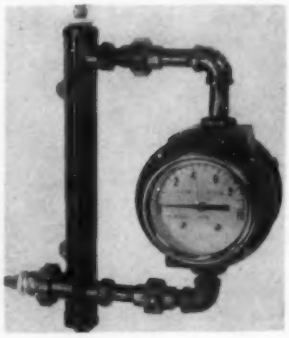
RAYBESTOS-MANHATTAN, INC., Packings • Asbestos Textiles • Industrial Rubber, Engineered Plastic, and Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings • Brake Blocks • Clutch Facings • Laundry Pads and Covers • Bowling Balls

For more data circle 536 on Post Card

presence of chemical atmospheres, moisture and radical temperature changes. Described as a non-catalytic varnish and having unlimited tank life, Thermopoxy T-653-LB can be applied by brush, dip, spray or vacuum impregnation. The material cures throughout upon exposure to a baking temperature of 135–150 C., says company, and upon curing develops a coating having exceptional adhesion and bonding strength. It is claimed to resist action of all types of chemicals including moisture, and also withstands exposure to temperatures from —55 to 200 C. The Sterling Varnish Co.

25—VANE-TYPE FLOWMETER for air or gas, is simply designed

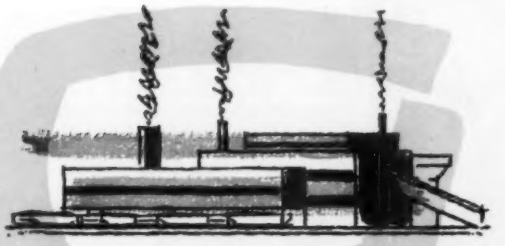
Model 1050, a vane-type flowmeter, is designed for constant pressure drop across the meter. It may be used for indicating, controlling, signal alarm, safety shutoff, sequence starting or shutdown, and similar applications. Operation is described as extremely simple. As the vane rotates with increase in flow, the area between the end of the vane and



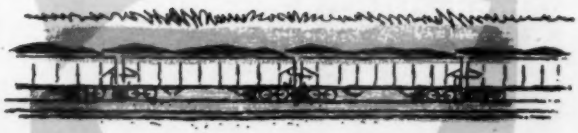
the flexible spline in the meter body increases. This increase approximates the law of squares to provide pointer stability and an easy-to-read scale. By varying the weight of the vane, and the area, various capacities can be produced. The area is shaped to provide an evenly divided scale. Pointer movement on the dial is multiplied by gearing to produce a dial that is easily read at a distance. Simple adjustments are provided to correct calibration for densities of different gases. The meter cannot be damaged by overrange flow or overpressure, company claims, and because it is a dry meter, no zero adjustments are necessary. These flowmeters are made in three standard body sizes with standard scale diameters of 4½ and 6 in. Readable accuracy is given as ½ of 1 per cent, calibrated accuracy from 2 to 5 per cent. For scale ranges up to 50 cfm, all the gas passes through the meter making it practically independent of pipe restrictions and elbows. Scale ranges over 50 cfm are connected in shunt. Meter body and companion parts are aluminum with brass or stainless steel trim. The meter is designed for either wall or panel-mounting. Scully-Jones & Co.

26—OIL DRAIN VALVE for substation type transformers

For use on substation type distribution transformers (250, 333 and 500 kva) and larger power transformers, this valve is designed to let all transformer oil drain



—engineered preparation



—by rail

from your own "back yard"....

—by riverways barges

—by deep water vessels

SOUTHERN brings you all the premium value, special purpose coals you need—23 million tons a year; ideally functional in variety at savings that lower power and heat costs. In this tremendous combined tonnage of Southern, Sinclair and Peabody Coal Companies there's coal to satisfy any quantity and burning requirement—coal from preferred seams and districts in your own bituminous-rich Mid-America.*

Obviously you save from Southern's low-cost, mechanized recovery, and with the clean, high BTU content and efficient burning performance assured by Southern's precisely engineered preparation.

But Southern gives you still another all-important saving—more favorable shipping rates from "close-to-home" supply sources—swift, direct by rail, by riverways barges and deep water vessels to all ports on the Great Lakes. Your nearby Southern representative will be glad to give you interesting figures.

* PREMIUM COALS FROM **27 BIG MINES**

in Eastern Kentucky; Western Kentucky; Ohio; Indiana; northern, central and southern Illinois; Iowa; Oklahoma; Alabama and Missouri.

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COAL COMPANY, INC.

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OFFICES IN: LOUISVILLE, MEMPHIS, MINNEAPOLIS, NASHVILLE, ST. LOUIS
SINCLAIR COAL COMPANY, KANSAS CITY 5, MO., WESTERN REPRESENTATIVE

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R-P&C's complete line of Cast Steel Valves and Fittings

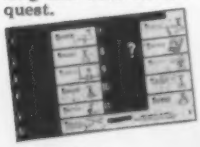
—SIZES UP TO 24"

—PRESSURE CLASSES FROM 150 TO 2500 LBS.

• R-P&C's valve line includes a complete selection of cast steel valves and fittings. These are manufactured in all standard valve steels in a complete range of sizes, pressure classes, and styles.

• Included are gates, globes and angles, swing and lift checks, in a wide range of constructions, and all classes of flanged fittings. Pressure sealed designs for high temperatures and pressures, automatic stop and check valves, and many other special purpose valves and fittings complete the line.

FREE WALL CHART
"How to Protect Your Valves"
17" x 11" wall chart gives installation and operation pointers to protect valves, prolong life. Free on request.



• All R-P&C steel valves and fittings conform to the exacting standards of design and manufacture that users have learned to expect from R-P&C. And all are providing, in many different applications, the dependability that is the R-P&C standard.

See your R-P&C distributor or write for R-P&C's convenient catalog

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

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out freely. The valve seat, positioned to be ⅛ in. below the transformer tank bottom plate, is made of nylon and brass. This compact valve requires less floor space since it does not project as far from the tank wall as many valves. To eliminate leaky pipe threads, the valve bolts to a heavy flange nipple where it is sealed by a corprene gasket confined in a gasket retaining groove. The sampling valve is mounted high on the valve body. On standard models, the sampling device operates only when the drain valve is open (according to NEMA standards) but special drain valves are available with sampling devices that operate without opening drain valve. Moloney Electric Co.

27—ISOLATED PHASE BUS is strong and lightweight

New advantages for safely conducting large concentrations of power are announced for this isolated phase bus design. An all-welded, aluminum basic assembly, factory fabricated and shipped in one piece, it combines strength, light weight and structural simplicity. Normal mounting conditions permit use of two supporting rings for each basic assembly, to give rigidity and quick alignment. Easy opening for inspection is gained from a telescope-type two-way sliding cover with V-clamp closure, which requires but one, single-piece, O-ring gasket in each cover joint. Completed structures have smooth inside surfaces, offering no pockets to collect moisture. Bulletins 10004-A and 10004-B give details. I-T-E Circuit Breaker Co.

28—TURBO BLOWER for oil burner operation

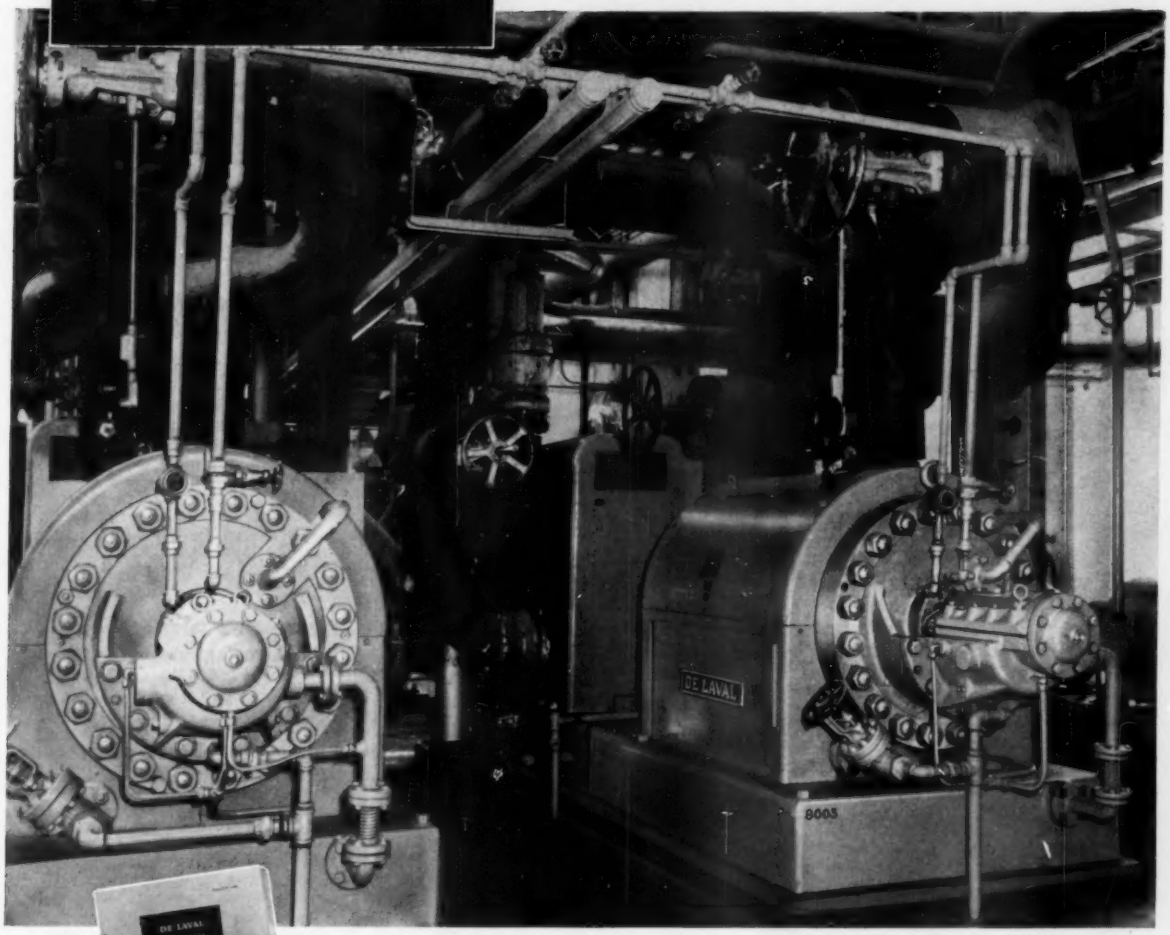
The Design C Turbo is a 28-oz, 30-hp blower unit capable of delivering 2650 cfm and designed for oil burner operation. Its perfect circle housing has a large diffusion area, says company, and velocity pressure is converted to static pressure within the housing itself. Venturi design of inlet side reduces intake shock, it is noted, and facilitates smoother air flow. Blower lends itself particularly to multiple burner and multiple outlet applications. In fact, the design encompasses a wide range of usage, company notes, such as pneumatic conveying of materials (where materials do not go through fan), burner applications, cupola furnaces, grain drying, aeriation, chemical processing, food processing. When properly equipped with sealing devices the turbo may be used as a gas booster. It may be supplied with wheels made from aluminum, mild steel or stainless steel. Discharge is rotatable. Performance chart on unit shows a relatively flat static pressure curve. Bulletin CB 108R gives more details. General Blower Co.

29—POTENTIOMETER-RECORDER is self-contained type

The Series 8000 Electronic Potentiometer Recorder of the null-balancing type is completely self-contained, it is announced, and requires only an external sensing device. It has been designed to provide maximum accuracy, simple operation, and minimum maintenance, and is available in a wide range of models which measure, indicate, control, and give a permanent record of such

DE LAVAL
BARREL TYPE BOILER FEED PUMPS

give dependable service at Gaylord Container



Bulletin contains helpful data

Bulletin 1506 on the De Laval barrel type boiler feed pump covers all major design points... has cross-section cutaway illustration for easy reference. Write for your copy.

Here's additional proof of De Laval reliability on the line in the Bogalusa, La. plant of the Gaylord Container Corporation. These two De Laval barrel type boiler feed pumps are both driven by De Laval MCP turbines operating at 850 psi, with steam temperature at 825 F.

• De Laval barrel type boiler feed pumps are widely used by industrial plants and public utilities. They operate at pressures up to 5,500 psi. These units offer many important design advantages, such as double volute diaphragm, individual diaphragm bolting, positive sealing between suction and discharge chamber and bare shaft construction. Their dependability is proven by year-in, year-out service.

DE LAVAL *Boiler Feed Pumps*

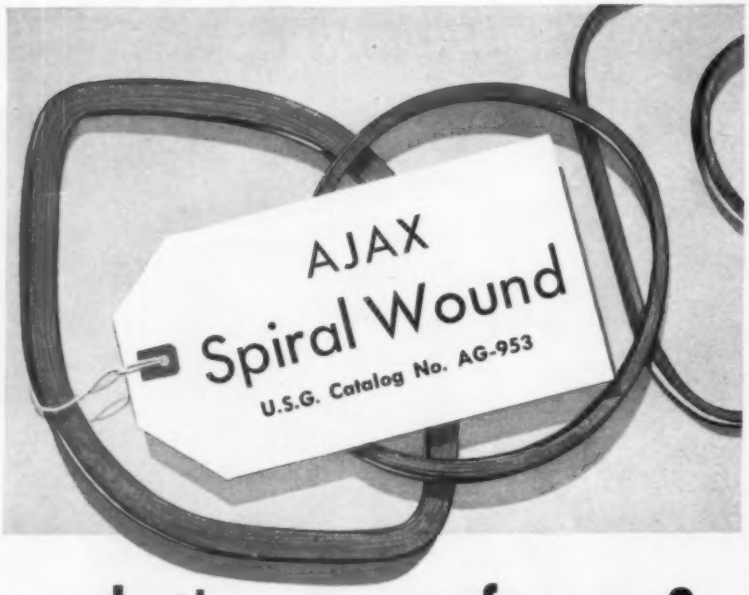
DE LAVAL STEAM TURBINE COMPANY

816 Nottingham Way, Trenton 2, New Jersey

DL 329

For more data circle 539 on Post Card

Boiler Gaskets . . .



. . what's your preference?

Yes, the U. S. Gasket—Belmont Packing line of Boiler Gaskets includes *both* popular types—spiral wound metal-asbestos and wire-inserted woven asbestos—for manholes, handholes and tube caps of all makes of stationary and marine boilers, waterwalls, economizers and other boiler accessories.

So, whatever your preference and operating pressure requirements, ask your U. S. Gasket—Belmont Packing distributor—or write for literature.

ask your U G BELMONT Distributor

United States Gasket Co.
Camden 1, New Jersey
Belmont Packing & Rubber Co.
Butler & Sepviva Sts., Phila. 37, Pa.

U.S. GASKET • BELMONT PACKING

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variables as temperature, speed, strain, hydrogen ion (pH), and other quantities that can be resolved into electrical signals.

Applications for the unit include measurement and control of temperatures in the pyrometric range; as a resistance thermometer-type of system; measurement of speed; as a radiation receiver; and for any function which can be resolved to a d-c signal load and the measurement of pressure through use of a strain gage. Accessibility and easy adjustment is provided by outer door that swings open 180 deg. Both the chart rolls and chart and recorder drive assembly swing out 180 deg the opposite way. Instrument is available in standard scale ranges which can be changed without use of soldering iron or need to change slidewire. Amplifier chassis uses plug-in components with standard electronic tubes. Wheelco Instruments Div., Barber-Colman Co.

30—SIDE-BREAK SWITCHES are braidless type

This line of braidless side-break switches features new high pressure contacts throughout and low friction swivel terminals. Braids are completely eliminated by means of newly developed high pressure "on center" contacts at all rotating contact points. Switches include center-break, single-break, and double side-break switches in a wide range of voltage and ampere ratings to 1200 amp as well as both standard and heavy fault ratings. Delta Star Electric Div., H. K. Porter Co., Inc.

31—CONTROL PANELS, SYSTEMS feature improved circuitry

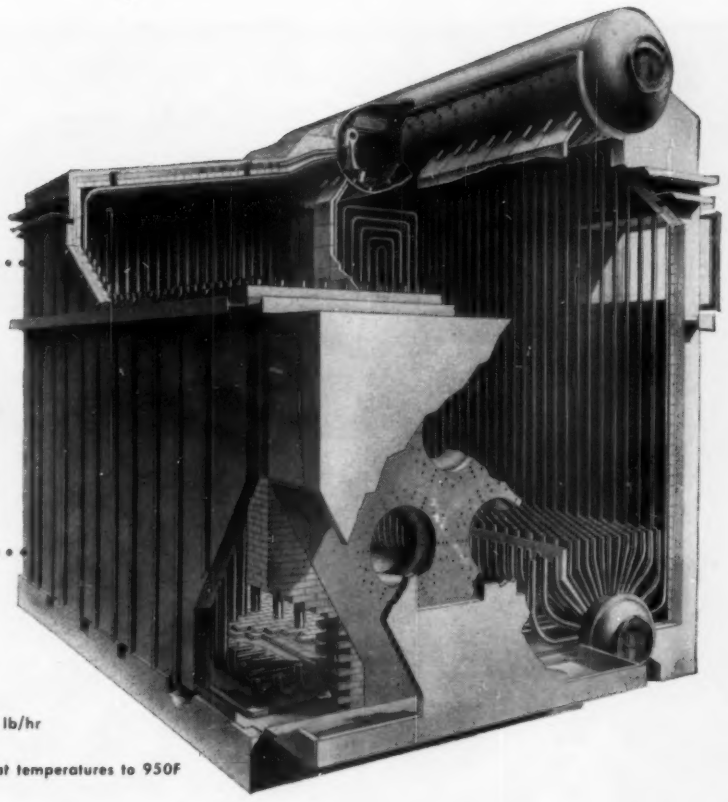
Designed for specific control of a process or machine, complete control panels are announced for explosion-proof operation, as well as for dust-tight watertight, drip-proof or regular use. Each system is compactly built and features improved circuitry designed to maintain reliability. Typical examples include discharge gas dust collecting controls, automatic operation of wet pit pump networks, liquid batch mixing controls, air filter collection system panels, automatic feed control station. Deveo Engineering Inc.

32—BRONZE VALVES, higher pressure, throttling globe type

LQ600-200 Bronze Globe Valves, rated at 200 lb steam pressure and at 400 lb water, oil and gas pressure, are declared ideal companion valves to this manufacturer's 150-lb SP, 300-lb WOG valves introduced last year. Addition of the new line answers a need for a higher-pressure, throttling globe valve. Design and construction features of both lines are identical. Bodies and bonnets of the new valves, however, are made of company's S-1 bronze, a close-grained bronze reported to feature extremely high density, strength and corrosion resistance. Like the previously introduced bronze valves, the new ones incorporate Brinalloy seats and discs for wear and corrosion resistance, Stemalloy stem for minimizing of thread wear, and flat-seat design — seats and discs are lapped to obtain a smooth, flat, leak-proof seal. Lunkenheimer Co.

more Equipment News page 126

Series "SC" STANDARD Steam Generator



FUELS: Oil or Gas
CAPACITIES: 50,000 to 150,000 lb/hr
STEAM PRESSURES: to 1500 psi
STEAM TEMPERATURES: Superheat temperatures to 950F

PRE-ENGINEERED FOR SAVINGS

in first cost, installation, operation, maintenance

Series "SC" Steam Generator is of the pre-engineered, standardized design, with all exterior and structural details fixed. Available in nine sizes, with capacities of 50,000 to 150,000 lbs steam per hr, it incorporates many advanced design features — as noted in the accompanying list — that make possible important savings in industrial steam costs.

Burners, controls, upper drum mountings and other equipment requiring attention are located at the front of the unit. Heat recovery equipment and fans can be placed near the operating aisle for either single or multi-unit installations, providing unusual accessibility and ease of operation.

Write us today for further information on how the Series "SC" Standard Steam Generator can meet your individual plant needs for power or process work. *Foster Wheeler Corporation, 165 Broadway, New York 6, New York.*

FEATURES AT A GLANCE

- Completely water-cooled furnace
- Over 19-foot firing depth
- Unrestricted circulation
- All-welded casing
- Fully drainable superheater
- Efficient convection surface
- Bottom supported unit
- Steam purifying system
- Full insulation

FOSTER WHEELER

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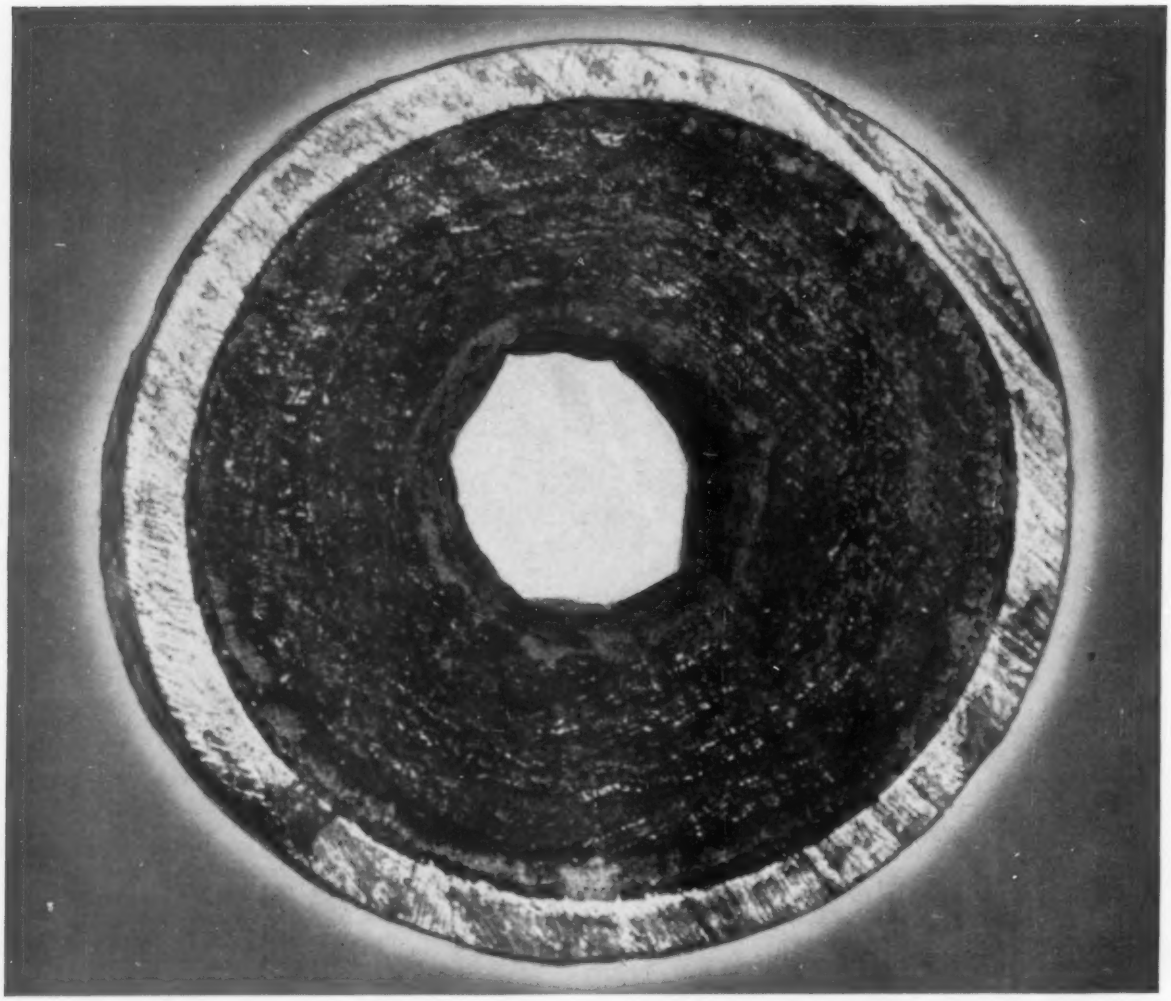

END OF THE LINE

SCALE—layer upon layer of it—has reduced the inside diameter of this pipe to practically nothing. It's a common occurrence in some power plants, and the results are costly. The line must be taken out of service. That means production loss and expensive maintenance or replacement.

Scale, sludge, carry-over, and return-line corrosion are but a few of the problems that must be overcome to assure efficiency in boiler plant operation. In Dearborn's complete line of water conditioning products, there is the correct treatment to eliminate every water trouble—the properly balanced treatment to reduce unnecessary maintenance, avoid shutdowns, and protect valuable equipment.

Since 1887, Dearborn products have provided trouble-free water to users of steam in all types of industry. That's why, today, power engineers in leading industrial plants throughout the nation look to Dearborn for consultation and assistance in solving their water treating problems.

MAIL THE COUPON

Dearborn Chemical Company, Dept. PG
Merchandise Mart Plaza, Chicago 54, Ill.
Please send me complete information on Dearborn Water Conditioning.

Name.....*Title*.....
Company.....
Address.....
City.....*Zone*....*State*.....

Dearborn®

...a leader in water conditioning and corrosion control

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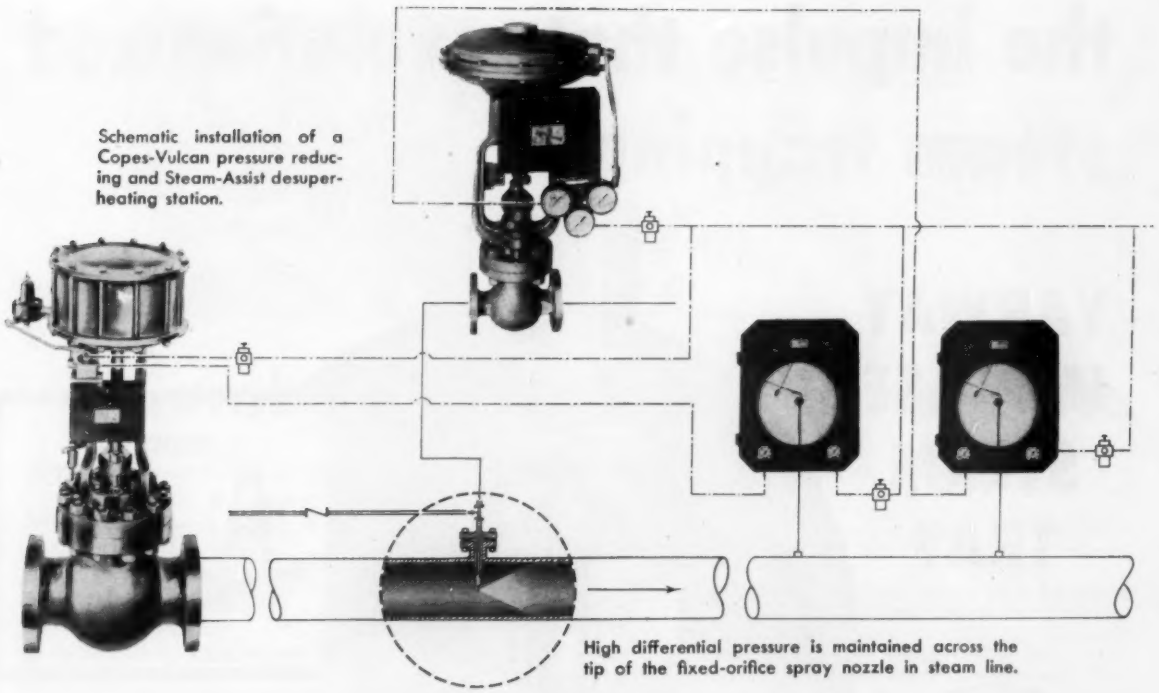
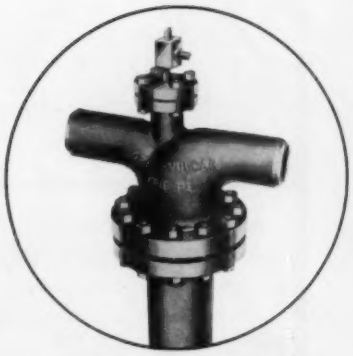


Schematic installation of a Copes-Vulcan pressure reducing and Steam-Assist desuperheating station.

High differential pressure is maintained across the tip of the fixed-orifice spray nozzle in steam line.

NEW Copes-Vulcan Pressure Reducing and Desuperheating Stations



Copes-Vulcan offers in-line or carburetor type Steam-Assist, or simple mechanical-atomizing desuperheaters.

These high-quality pressure reducing and desuperheating stations offer the latest advances in reducing valves and desuperheaters. They give you an integrated station designed specifically to meet your operating needs.

Copes-Vulcan valves—diaphragm or piston operated, depending on your conditions—give close modulating control. Simplified design means optimum operating characteristics with easy, low-cost maintenance.

The Steam-Assist Desuperheater advances a new principle in reducing steam temperatures. Cooling water and assisting steam are mixed in the exclusive swirl chamber, upstream from the point of injection. No large steam bubbles form to cause hammer or vibration. Flow of assisting steam can be automatically reduced as load increases, and shut off completely at high loads where no more than mechanical atomization is needed.

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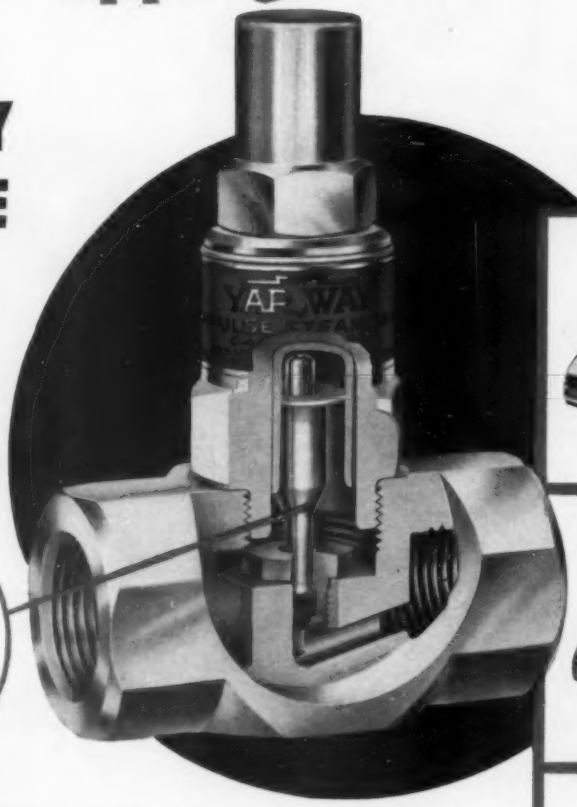

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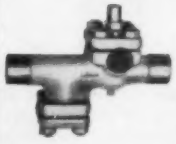

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Fig. 1. Generator windings get "cobbed"

Cambridge Cobs Its Generators

"Cobbing" generators is not a new process—it has been practiced for some years, particularly in the Midwest where corncobs are available in abundance. Little, however, has appeared in print to describe the method by which this process is used to clean up generators with an air-blasted, ground-up corncob spray

By DONALD L. COCHRANE*

THE RURAL Cooperative Power Association of Elk River, Minn., has five diesel plants in which nine of fifteen generators have now been cleaned with success and efficiency by air-blasted corn cobs. Some of the units had previously been cleaned with air-blasted solvents, but with little success in getting them really *clean*. This article covers the work at their Cambridge Plant. It is the largest of their diesel plants and is located just north of the city of Cambridge, Minn.

We make several preparatory steps before the actual cobbing operation begins. First, the generator breaker, disconnects, and the field breaker are opened. We then remove all guards, piping, brush racks and any other impediments to moving the stator. Next, we make all of the cable and stress-cone disconnections and take the first insulation checks on the generator stator, rotor, exciter rotor, and field, generator, exciter cables.

We use a 500-v dc megger for these checks and set our minimums at 1 megohm for everything under 1000 v, and 1 meg per 1000 v for everything over 1000 volts. As each lead is disconnected we mark the ends by wiring on like-numbered washers to assure getting them all back in their proper places. At this time we vacuum the generator pit thoroughly to remove all loose and abrasive material.

We have a 300-a, 40-v d-c welder which we hook up to the generator leads; we operate this at 150 to 200 a to keep the generator coils warm, to drive out moisture that may be in the coils, and to prevent any pickup during the operation. Our welder is rated at only 50-per cent duty so we do not operate it continuously any higher than the rate given.

The cobbing work is done only during the day shift, at which time the welder runs at 190–200 a; during the rest of the time, it is set at 150 a. Two centigrade thermometers are set in small wads of Duxseal on adjacent windings for the purpose of

* Superintendent, Cambridge Plant, Rural Cooperative Power Association, Minn.

Fig. 2. Plastic and canvas housing erected over generator before cobbing. Crane hook holds up top for more headroom

Fig. 3. Helper fills cobber. 50-lb bags are easy to handle and can be reused to store used cobs reclaimed from the job

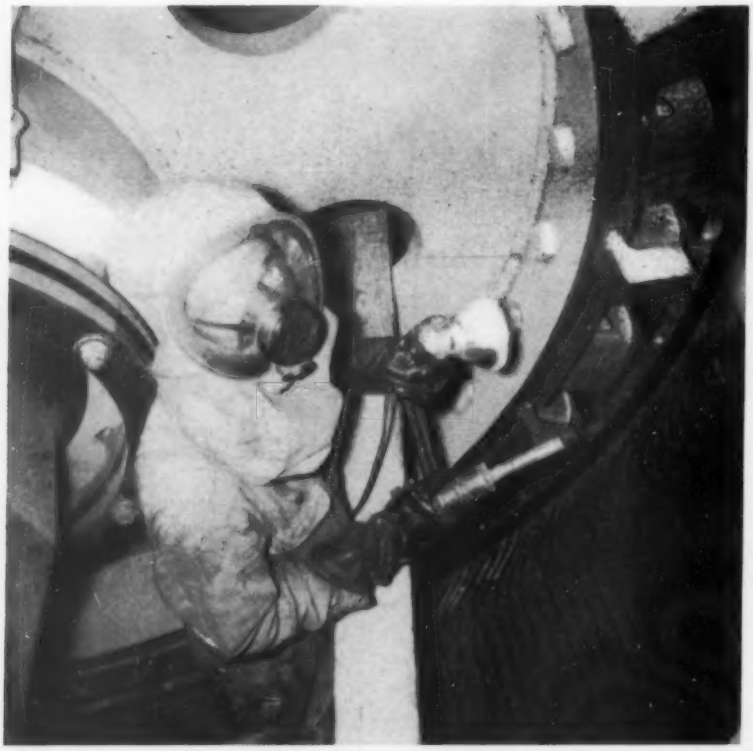


Fig. 4. Spaceman and satellite?—not exactly. Operator demonstrates protective clothing necessary when cobbing; flying cobs from gun can abrade skin fast

Fig. 5. Close-up of cobbing spray in action. Workman holds light in left hand, gun nozzle in right. Cob deposit over surfaces shows need for thorough cleanup

comparative readings; the operators are instructed to check them once each hour to see that they do not show over 55 C. Temperatures average between 20 and 30 C, depending on the size of the machine.

Check Rotor Clearance

At this point, we prepare to move the stator. Before doing this, however, we first check the rotor clearance every 90 degrees and note readings for comparative purposes when reassembling. The moving of the stator is an easy job for us as we have good overhead cranes and, on the smaller units, notched pads from which to bar the stator after applying grease to the pad. However it is done, the important thing is to move them slowly and in a straight line to avoid damage. Shims that must be removed from beneath the stator before moving it should be tagged for location. Each end of the stator can be picked up separately to remove the shims; this can be done either with a crane or the jack bolts provided on some machines.

Cobbing is a somewhat dusty operation, so we build a plastic and canvas house on a 2-by-4 frame over each unit before starting. We have some large painter's dropcloths for the sides, and a large sheet of clear plastic for the ceiling; in the case of the smaller units, we use another for one side also. The plastic sheets let in light so a man can see clearly inside without a light; a light is necessary, however, for the actual cleaning. An all-plastic housing would probably be more dustproof.

We are now ready to begin the actual cobbing. The man to do the job dons the protective equipment, picks up the nozzle and hand light, and gets in position. The operator who has previously filled the cobber turns on the air to the tank, then to the nozzle and then opens the cob valve. With the pressure on the nozzle air set at five to seven pounds and the tank air a pound or two higher, a gentle stream of cobs will emerge from the nozzle and carry away the dirt, lint, and grease, leaving clean, dry insulation.

Beware High Pressures

Higher pressures than those mentioned will clean faster, but the chances of damaging the insulation are increased, as a pause in the movement of the hose may take some of it off. Also, at the lower pressure we use, fewer return passes are necessary to a given spot to get it clean as the stream can be held there sufficiently long to finish it the first time. Furthermore, at low pressure, the nozzle can be held close enough to the windings to clean between them with more effectiveness, since the blast can be concentrated for a short time without damaging insulation.

It has been our experience that some makes of generators are more easily cleaned than others due to

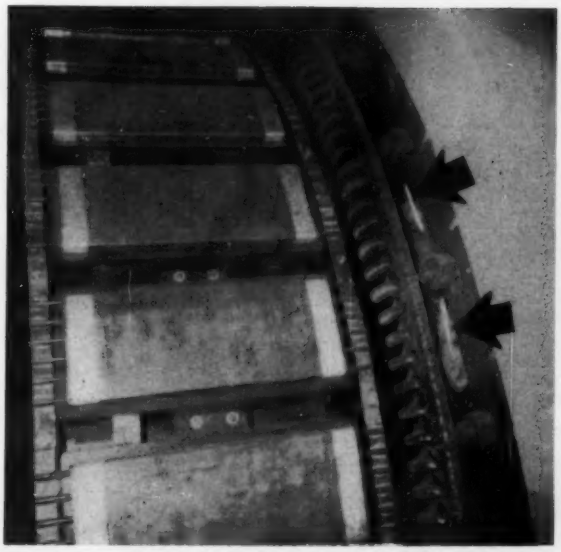


Fig. 6. Arrows show position of thermometers imbedded in Duxseal on stator windings; readings are checked regularly

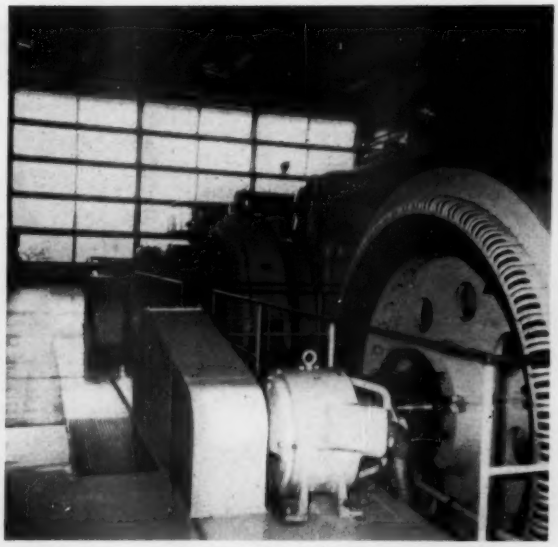


Fig. 7. These are the diesel-driven generators which were cleaned by the "corncob" method described in this article

methods of construction, insulation type, and workmanship. Occasional flaking off of varnish or outer layer of insulation occurs on any of them but on some more often than others. An insulation bonding that is weak or brittle will be disclosed by flaking off at the first touch of the cobs and air.

The man taking care of the cobber can tell how the machine is working by the sound of the air as it leaves the nozzle — quietly, if the cobs are coming just right, pulsing if cob feed is too heavy, and loud and "whistly" if feed is too light or only air is going through. We find that toward the end of the cob load an occasional bouncing of the cobber on its stand will contribute toward emptying the machine with an uninterrupted cob flow.

When we first started cleaning generators by this method, we plugged the hose as result of mishandling of the pressure valves, etc. If this occurs, shut off the cob valve and then remove the nozzle from the hose. The trouble may be right there; if not, have someone hold the hose pointed in a safe direction and then raise the pressure to about 60 psi. If the hose does not clear itself, use a hammer to tap the hose until a hard spot is detected; a few blows around this area will soon clear out the obstacle.

It takes about one hour to push 150 lb of cobs through the cobber at the pressures we use. Our generators have averaged about 1000 lb of cobs per unit. We use the cobs twice, the first time for the stator windings, after which they are picked up and screened and used again for the fields. We had our best success with #10 grit cobs, the cost coming to about $30 per unit for cobs.

To pick up cobs, we first use a shovel, then a vacuum cleaner. The cobbing usually covers a period of from two to three days, one electrician doing all of the work except for loading the machine and watching its operation.

As soon as we are done with the cleaning, we use the same low-pressure air to blow out the generator the first time, as it will move the cobs out, let them drop into the pit, and yet not blow them over areas already blown out. We tear down the house, vacuum the pit, generator frame, and the general area, then give another blowndown with higher air pressure to move a few of the more difficult cobs and some that may be hidden from sight. Another vacuuming gets rid of these, then a spray-down with a mild, fast evaporating solvent rinses the smaller dust particles away. We use a common solvent which we obtain from our lube oil supplier. In a short time, the windings are dry again.

Repair Insulation

Next comes the final close inspection and repair of any weak spots in the insulation. Flaked-off areas are built up even with the surrounding area with several coats of varnish, each allowed to dry thoroughly. This can be done with brush or spray. Any of the larger areas are given a few layers of varnished cambric and additional varnish. After the patchwork is done, we put on three over-all spray coats with sufficient drying time between coats. There are so many hard to reach places in the stator windings that extra care must be taken to get a good coating on all sides.

As soon as the last coat of varnish is on, we carefully slide the stator back in place, install shims, check rotor clearance, do any painting necessary on the flywheel side of the rotor, and replace stator winding guards. After the generator terminals are connected to their respective cables, we apply Duxseal to the connections to seal out moisture and smooth the connection for good taping. We use 12 layers of varnished cambric and about 5 layers of Scotch #22, which makes a good-looking job. The stress cone tails are then rebraided and connected to their mutual ground lead.

On our two smaller units, we cobbed the exciters in the same manner as the generators, then turned the commutators smooth and checked the bearings before varnishing and reassembly.

It should be noted that the welder was feeding current during the whole operation except for a few minutes every hour during the day when we would disconnect the leads and take a resistance reading to determine any trend that might show up. All of our readings were consistently in the range of 400 to 500 megohms; as ours is 2400-v equipment, we considered such readings good. These readings were the result of one minute's operation of a 500-v megger. Doing this work during the winter helps because the air is dry and there is less chance for the equipment to pick up moisture.

The manhours for operating the cobber and cleaning a generator comes to between 24 and 30 hr. The time spent on associated work depends largely on the circumstances of the installation and its necessary availability. However, we believe we have done a first-class job on our machines and that it will last for some time.

The machine used to blast the cobs is a Pangborn AC4 soft abrasive blast-cleaning machine.

Overhauling Turbine Generator Auxiliary

Fig. 1. Steam admission valves with new pins and bushings in control linkage

This is the fourteenth article in a series describing the scheduled overhaul of a 25,000 kw turbine generator at U. S. Steel Corp.'s South Works in Chicago. This article describes the inspection and overhaul of auxiliary equipment carried out while work was in progress on the main units

WHILE THE MAJOR units were being inspected and overhauled, the auxiliary equipment was also inspected and restored to full operating efficiency. Work on auxiliaries must be carefully planned and coördinated to avoid one job interfering with another and to have them all completed when the major unit is ready for testing.

For purposes of discussing the inspection and overhaul of the auxiliaries they will be grouped into six general sections as follows: Turbine Condenser System; Lubrication and Hydraulic Systems; Turbine Steam Admission System; Extraction Heater System; Generator Auxiliaries, and Miscellaneous.

When all these articles have been published the series will be reprinted. The reprints can be used for training young engineers, briefing new men before an overhaul, etc. To reserve one or more copies of the reprint write to the Editor

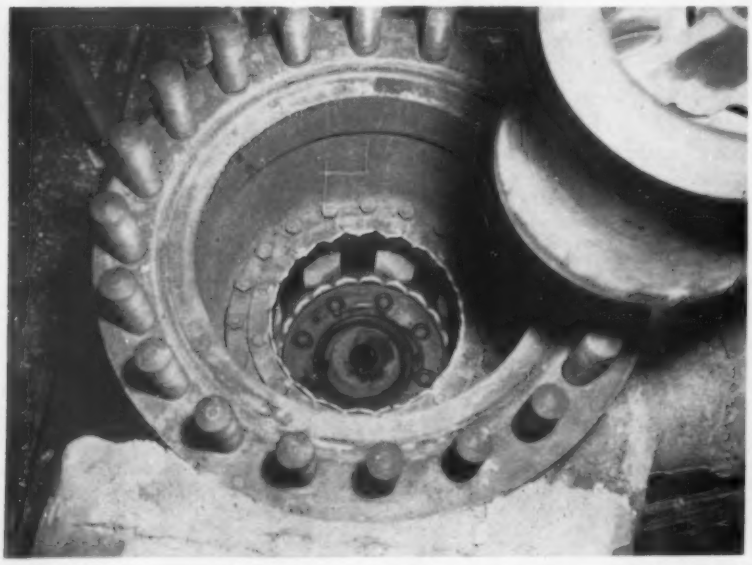


Fig. 2. Shows steam admission valve ready to be lapped to ensure a tight shut-off

Steam Admission Equipment

Steam Strainer: The steam strainer was dismantled and the basket inspected for holes or deterioration which might allow foreign material to enter the turbine with the steam.

Throttle Trip Valve: The throttle trip valve was completely dismantled, cleaned and inspected. Particular attention was given to the tripping mechanism which closes the valve under emergency conditions. The valve stem was polished to insure maximum life for the new packing.

Steam Admission Valves: The three steam admission valves, Fig. 1, were dismantled and reconditioned. The tertiary valve disk was found to be loose on the stem and was replaced by a new cage and disc. Poor regulation of the unit prior to shut down indicated this condition should be looked for. Grinding compound was applied to the upper and lower seats as shown in Fig. 2 and the disc lapped into them.

Figure 3 shows the valve disk being lowered for lapping. The stem and disk were supported by a spring from a chainfall on the crane and lowered within about an inch of the seats. By pushing down on the disk it could be lightly lapped, whereas if the spring were not used the weight of the disk might score the seats. Figure 4 shows the partly assembled primary valve being repacked.

Steam Admission Valve Operating Cylinder: The steam admission valve operating cylinder was overhauled. All control linkage was carefully inspected for lost motion. Where necessary worn pins and bushings were replaced.

Extraction Feed Water Heaters

Heater Heads: The top and bottom heads of both heaters were removed so the tubes could be drilled. Safety valves were overhauled and tested. The heaters were reassembled and tested for leaks.

Valves: The valves in all extraction lines were inspected, reseated where necessary, and repacked.

Condensate Level Control: The condensate level control and heater drain pumps were inspected and overhauled. A section of condensate line between drain pumps and boiler house had eroded and was replaced.

Turbine Condenser System

Turbine Condenser: The Turbine condenser, Fig. 5, was cleaned by shooting rubber plugs through the tubes with an air gun. After cleaning, it was thoroughly inspected both inside and outside for broken stay bolts, distorted baffles and evidence of erosion or corrosion. The condenser was supported on jacks and filled with water to test for leaks in the tubes or shell. The few leaking tubes found were plugged at both ends by soft wooden plugs.

Atmospheric Relief Valve: The atmospheric relief valve was cleaned and the valve disk reseated. The water supply and drain lines for the seal had rusted badly and were replaced. The stack, Fig. 6, was inspected for evidence of deterioration.

Condensate Removal Pumps: The condensate removal pumps were completely dismantled. The impellers of one pump were badly cavitated and were replaced. Bearings were inspected and replaced where necessary.

Circulating Water Pumps: Both circulating water pumps, Fig. 7, were removed and dismantled. One pump was found to be in good condition except for a cracked impeller, which was replaced. The other pump was completely rebuilt with new shaft sleeves, rubber lined shaft bearings, impeller shroud, impeller, shaft tube and thrust bearing. See Fig. 8.

Air Ejector: The air ejector was dismantled and cleaned. The tubes were tested for leaks and those found were replaced. All jets, including the auxiliary, were dismantled and inspected for restrictions. All valves were inspected, reseated when necessary, and repacked.

Fig. 3. Valve disk being lowered into cage for lapping. Note that other openings are covered with plates to prevent foreign matter from dropping into them

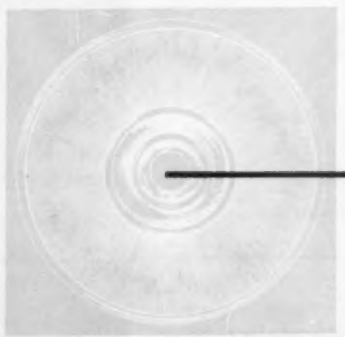


Fig. 4. Primary steam admission valve partly assembled and being repacked. Note threads on valve stem were taped to prevent damage during assembly

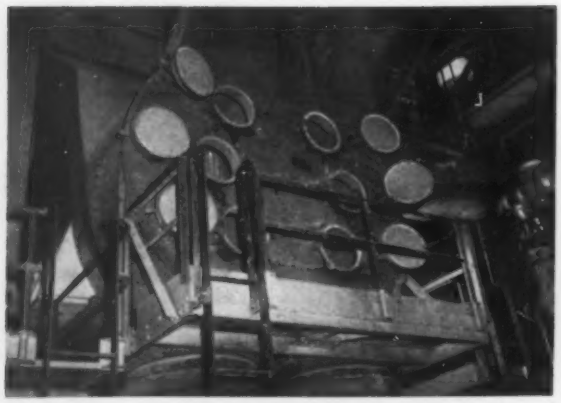


Fig. 5. View of condenser water box. Tubes were cleaned by shooting hard rubber plugs through them with an air gun

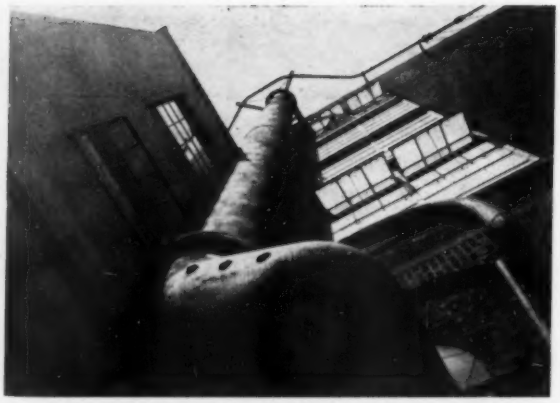
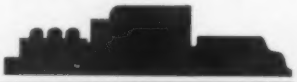


Fig. 6. Atmospheric relief stack. Steam from auxiliary oil pump and auxiliary air ejector jets also feed into this stack



Lubrication and Hydraulic Oil

Oil Pumps: All oil pumps including shaft driven lubricating and governor oil pumps, steam and motor driven auxiliary oil pumps and the 5,000 psi shaft jacking oil pumps were dismantled and inspected.

Oil System Regulators: The oil system regulators were cleaned and inspected for serviceability, adjusting screws freed up and diaphragms replaced where required. Particular care was taken during the overhaul of the main units and auxiliaries to prevent foreign material from getting into the oil lines. When joints were broken and left open they were blanked off with sheet metal disks. Lines were never sealed by stuffing rags in the pipe which might work into the lines. If wiping towels were used they were wrapped over the end of the pipe and tied with twine. Where possible, all oil lines were blown out with compressed air. Oil was circulated for several hours and pressures at various points noted before the unit was started.

Oil Filter: The oil filter was completely dismantled and thoroughly cleaned. Trays were repaired or replaced when necessary and new filter bags installed. The main reservoir was drained and cleaned. All oil returned to the units was pumped through the filter. The oil was tested by the lubrication engineer before it was returned to the system to make sure it was satisfactory.

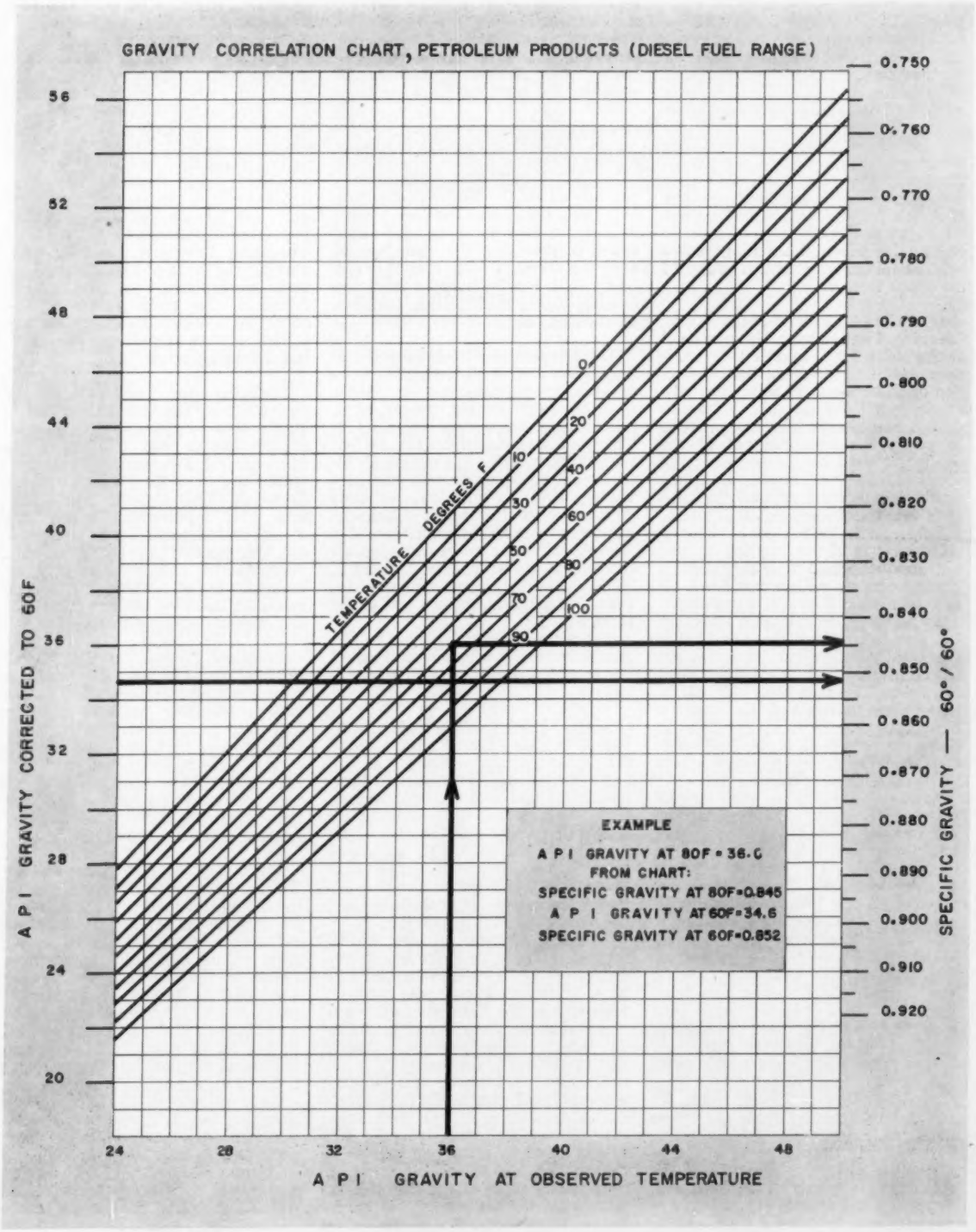
Oil Cooler Heads: Top and bottom heads on the oil coolers were removed and the tubes rodded out. The tube bundle was clamped in place with the heads off and hydrostatically tested for leaks. Valves were overhauled and repacked. A 1 in. by-pass was installed around the 4 in. water valves to permit better cooling water control during winter months when the water is cold.

Fig. 7. View of vertical drive motor for one of two condenser cooling water pumps

Fig. 8. Shows new impeller being fitted to one of the condenser cooling water pumps

Puzzled About Fuel Gravity? Use Chart

We are frequently asked how to convert API gravity to specific gravity and the relation of both to temperature. This chart by E. M. Sims of University of Oklahoma does it for you. For instance, fuel in example has API and specific gravities of 39.0 and 0.830 at 100 F. To work chart, follow example



Dairy Plant Refrigeration—How

By C. T. BAKER*

BECAUSE OF the variety of interesting and unorthodox practices which I encountered recently in the investigation of an ice cream and dairy plant, I believe the following story will be of interest to power engineers.

Both the refrigerating and the boiler plant were typical. Refrigeration was provided by four belted type vertical enclosed compressors, one of which operated alone on the low temperature load. This load consists of two ice cream hardening rooms held at minus 20 F and a group of ice cream freezers.

Operators' Queer Notions About Cleaning Condensers: Upon arrival at the plant, I was told that the engineer was "fixin' to clean the tubes of one of the horizontal shell and tube condensers." To do this, I learned that it had always been the practice to pump the ammonia out of the condenser shell before removing the water heads — otherwise ammonia would escape from around the tube ends into the water box. In addition, a helper was instructed to keep a constant gas flame applied to the bottom of the shell to be sure that all liquid ammonia within would boil off and be removed by the compressor.

It required considerable effort on my part to convince the crew that it was totally unnecessary to pump out the condenser shell in order to clean the tubes. It was equally difficult to make them understand that it was a dangerous practice to apply a hot gas flame to the bottom of the shell when the inside surface temperature was 25 or more degrees below zero.

While the pumping out process was taking place, I inquired of the plant engineer whether the tubes had been completely drained of water before starting. He replied that it wasn't necessary. Later, however, when the water heads were removed preparatory to scraping the tubes, it was found that they were leaking ammonia. Upon further investigation, I discovered that every one of the forty-six 1-in. tubes had been damaged from freezing and that complete renewal was necessary. This, of course, was very expensive.

The tubes were found to be heavily coated with muck and dirt.

No provision had been made for continuous drainage from the tower basin to hold down concentration, consequently the water carried large quantities of foreign matter into the tubes where much of it remained. Dumping and cleaning the basin was performed only twice a year, and to make matters worse, the condensing water pump suction line had no strainer.

A continuous drain has now been provided and water flows from the basin in an amount approximately equal to that resulting from evaporation.

Water for the compressor jackets was supplied by the condensing water pump. However, some of the jackets were not passing a sufficient quantity of water to properly cool the cylinder walls. When the jacket hand hole plates were removed, the water space surrounding the cylinders of each compressor was found to be badly fouled with deposits from the cooling tower basin. This, too, has been corrected.

The Evaporative Condenser: Some time after the shell and tube condensers were installed, a 25-ton evaporative condenser was put in to take care of extra capacity needed. This unit was placed on the roof of the building and it discharged its moist air horizontally into the prevailing wind. In addition, the ends of the short horizontal discharge neck were turned downward, making it even easier for moisture laden air to re-enter the condenser. Instead of 78 F wet bulb air reaching the intake, the air temperature was closer to 98 F.

The air outlet was changed to discharge vertically which cured most of the troubles resulting from re-circulation.

Safety Valves Were Not Safety Valves in This Plant: Figure 1 shows the general arrangement of the liquid receiver and two of the three horizontal shell and tube condensers. It can be seen that the top condenser shell is fitted with a dual safety valve, known as the A.S.R.E. approved type. Further, it will be noticed that there is a hand shut-off valve between the safety valve assembly and the shell of the top condenser.

The end elevation shows the arrangement used to make one safety valve serve two condensers and a 20 in. x 12 ft liquid ammonia receiver. Here again, the hand shut-off valve is found to be placed so as to render the safety valves inoperative insofar as the receiver is concerned.

Of the three pressure vessels in the assembly, only one would have safety valve protection if the two hand shut-off valves were closed. The operators stated that, as a rule, these valves remained closed.

In addition to increasing the opportunity for failure of the safety valves to perform, closing the valves shown in the sketches prevented equalizing pressure between the two condensers and the liquid receiver.

New dual safety valves were installed and the two stop valves shown are now held in the open position by means of a small chain and padlock.

A third horizontal shell and tube condenser (not shown in the sketches) operated without benefit of safety valve protection and without an equalizing pipe between this condenser and the two shown. The third unit was located about twenty-five feet from the others. A 1¼ in. pipe equalizing line was installed, connecting the tops of the shells of all three condensers. This considerably improved the performance of the condensers, ensuring better drainage to the receiver as well as a reduction in condensing pressure.

High Pressure Cut-Outs: At one period during the life of the plant, a high pressure cut-out, set to stop all compressors in case of failure of the condensing water supply, had protected the equipment against excess pressures. This cut-out was set to stop the compressors before the safety valves opened. For some reason, this piece of equipment had been disconnected and consequently remained out of service for several years. It has now been re-connected and placed back in service.

Pressure Gages: Of the various pressure gages in use, only two were approximately correct. For years false condensing pressure readings had been recorded on the plant log, because four high pressure gages in service were 20 to 25 pounds "fast." New gages have now replaced the defective ones and for the first time the operators know what the condensing pressure actually is.

High Cost of Low Temperature: The compressor handling the hardening rooms and operating the ice cream freezers was an 8 in. x 8 in. vertical two cylinder machine operating at 327 rpm. In order to hold the rooms at minus 20 F, the suction temperature was held at minus 40 F. At this temperature, the suction pressure was 10.41 lb absolute, corresponding to 8.7 in. of mercury. The specific volume of the liquid at this condition is 24.86 cu ft per lb. When the compressor operates at 185 lb condensing pressure, as is quite common in summer with cooling tower water, compression ratio becomes 19.2 to 1.

Temperature of the discharge gas measured at the compressor when operating under the above named

* Consulting Engineer

Not To Do It

conditions ranged from 300 to 325 F. A 60 hp, 208-volt motor driving the compressor operated at 40 per cent of full load rating.

Additional freezing and hardening room capacity will soon be installed and a booster compressor will be put in to handle the low temperature load, with the 8 in. x 8 in. compressor being retained as a second stage unit. This change to two-stage compression will not only greatly increase compressor capacity, but will also greatly reduce the hp per ton of refrigeration.

The annual average cost of electric power is close to 1½¢ per kwh. The change to two-stage compression will obviously have a decided effect on this expense.

Just why a single stage arrangement was selected in the beginning for the type of service required in this plan is hard to understand.

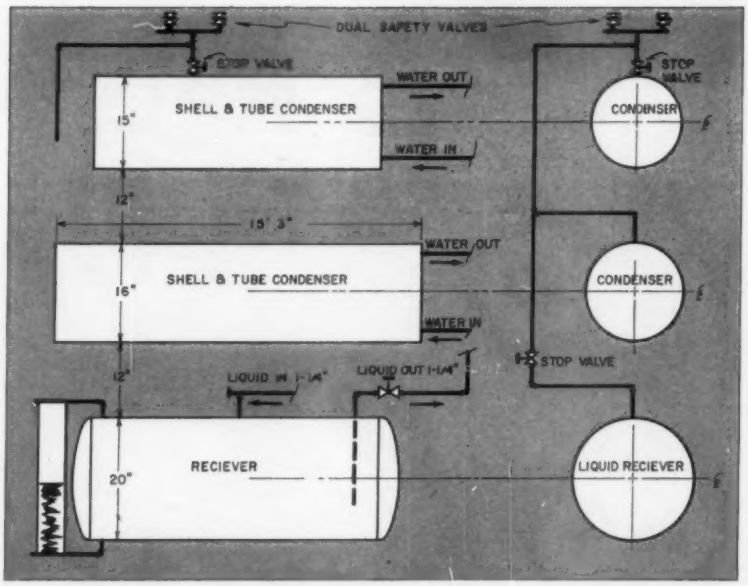


Fig. 1. Arrangement of two condensers and a liquid receiver showing dangerous valve arrangement in which two stop valves could prevent safety valve operation

Something Unusual in Hardening Room Practice: Each of the two hardening rooms is 33 ft long x 11 ft wide x 9 ft high in the clear. The rooms are cooled by shelf coils and each contains 3,855 lineal feet of 1½ in. pipe. As originally installed, the coils were operated fully flooded which was accomplished by a float-controlled expansion valve located in a float chamber. At some time in the plant's history, however, the float feed assembly was removed from one of the rooms and a hand expansion valve was substituted.

During winter months, the buildings were closed from 8 P.M. until 4 the next morning when the first employee came to work. During this period, one of the compressors was operated to hold the hardening room temperature at minus 20 F.

It was the practice, before the plant engineer left for home, to open the hand expansion valve on the coils and flood them with liquid. When satisfied that they were full, he closed the expansion valve and it remained so until the next morning. He figured that doing this kept the room at the desired temperature since, as he said, there was enough liquid in the coils to last all night.

Following this manual flooding of the coils, liquid often flooded over to the compressor, particularly if the crew in the freezing room happened to be storing fresh frozen cream. Because of the increase in quantity of heat entering the room, liquid in the coils boiled off at a rapid rate which was conducive to liquid carry-over to the compressor.

This practice was stopped and the float expansion valve assembly put back in service. It is doing a good job of regulating liquid flow to the coils.

A properly designed automatic float-actuated expansion valve now keeps the coils flooded by admitting liquid at the rate at which it is being evaporated. The float can be adjusted to hold the liquid level in the coils within very narrow limits. Such performance insures maximum cooling capacity because of greater heat transfer between the boiling refrigerant and the surrounding air, or liquid, as the case may be.

Courting Danger: The unattended compressor which supplied the wintertime night refrigeration operated without benefit of high-pressure-cutout to protect the plant against wreckage by excess condensing pressure. It also operated without the benefit of a bearing oil-pressure failure switch to stop the compressor if oil pressure to the bearings failed. Operating a plant in this manner is surely courting serious trouble.

Juggling Ammonia: Until just recently, the plant never had a full charge of ammonia. Because of this, all cooling operations could not be operated at once. For example, it was impossible to freeze cream and cool milk at the same time. It was necessary to stop one or the other operation so that the small amount of ammonia in the system could be concentrated on one operation.

Another condition that contributed to poor operations was the arrangement of the liquid piping which supplied the various locations where refrigeration was required. A 1¼ in. liquid outlet was connected to the liquid receiver. A ½-in. line led to the milk storage room and a little farther away a second ½-in. line was tapped to the main supply for a large water cooling tank. The hardening rooms and the ice cream freezers were also supplied through a ¾ in. line tapped from the 1¼ in. main. The net result of this hook-up was a serious pressure drop in the supply to the freezer and the hardening rooms. A 1¼-in. line was extended to the ice cream department and it eliminated pressure loss and flash gas in the line.

Here, too, longer operation of the freezers for a given amount of freezing caused high power bills.

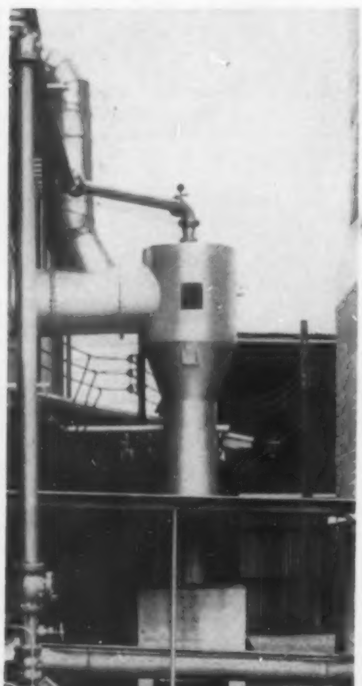
Oil Accumulations Caused Trouble: As no provision had been made for drawing oil from the coils in the ice cream hardening rooms, difficulty was experienced during summer months in maintaining desired room temperatures. When coils were opened a large quantity of oil was removed. Oil drains are now provided.

One reason for oil carry-over to the evaporators was the lack of oil separators. None of the four compressors in service had been provided with a high pressure oil trap to remove oil from the discharge gas before it reached the condensers. The reason for the failure to provide them is unknown — most likely though, the original purchaser of the refrigerating plant equipment was told that he could save money by doing without the protection of oil separators.

The several improvements already completed have eliminated many of the operating problems that have plagued the plant for a long time. The completion of the rehabilitation program will result not only in a saving in power cost, but will contribute greatly to plant capacity.

News Reel

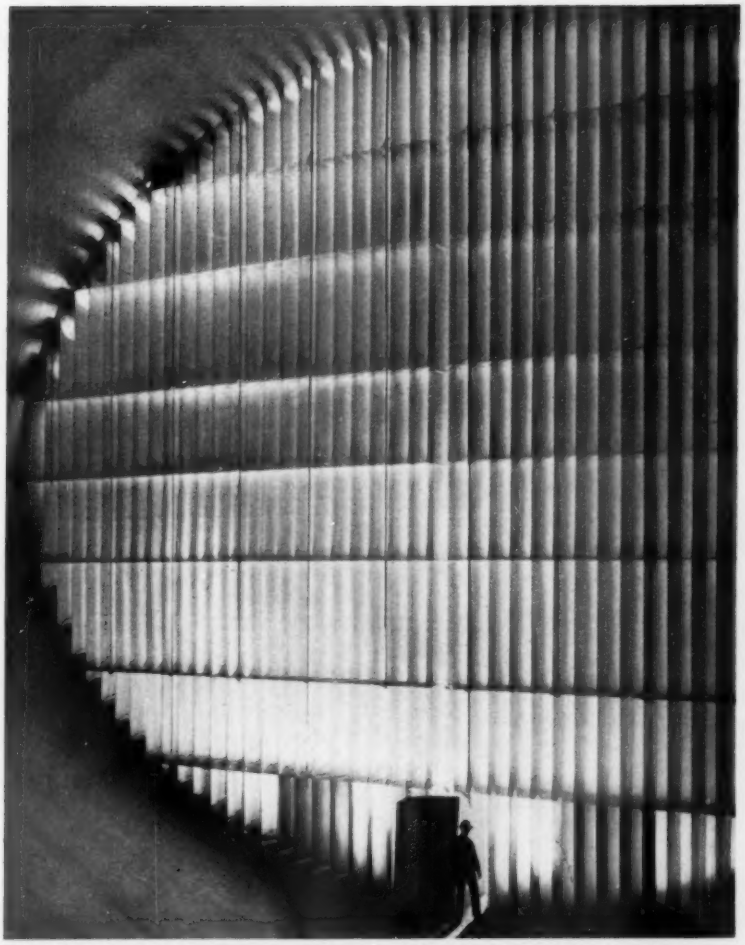
Puerto Rico Water Resources Authority's Puerto Nuevo steam-electric station is being doubled in capacity to 176,000 kw by the end of 1956. This expansion is only part ($16,000,000) of a $105,000,000 program to be completed by 1961–62 to bring annual generation for all needs up to 1,500,000,000 kwh



Soap plant troubled with ammonia fumes and hot air in working area passes them through S-K fume scrubber

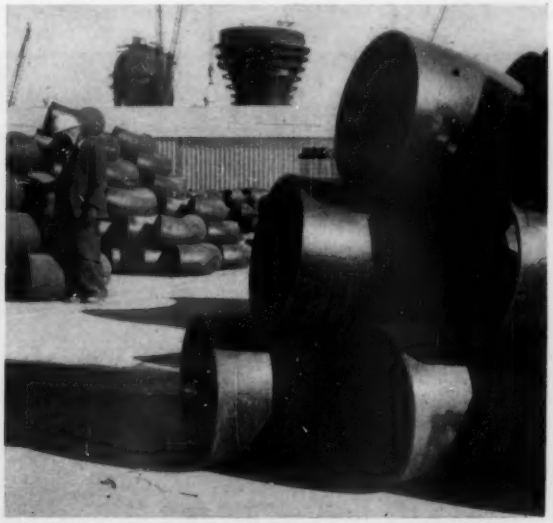
Workmen dismantling three vertical turbine generators at Commonwealth Edison's Fisk Station. These 12,000 kw sets were installed in 1909 and were among world's largest. They are being removed to make space for a single 305,000 kw unit

Low-cost construction for end opening flanges for hydrogen cooled synchronous condenser at Elliott Co's plant is obtained by use of forged and rough turned steel rings welded to the shell



Direction of wind tunnel's air flow is controlled by these giant turning vanes at the U. S. Air Force's Arnold Engineering Development Center, Tullahoma. Tunnel is 55 ft diam at this point and air passes through it at 1100 mph on its way to test section 16 ft sq by 40 ft, in which full size engines are mounted

Chrysler Corp's experimental automobile gas turbine. Many metallurgical and manufacturing problems have to be solved before passenger car turbines can be built in volume



Elbows for the 250 miles of piping to be installed in Tide Water Associated Oil Co's new refinery near Wilmington. In background are parts of two fluid catalytic cracking units

Know Your BF Pump Stuffing Boxes

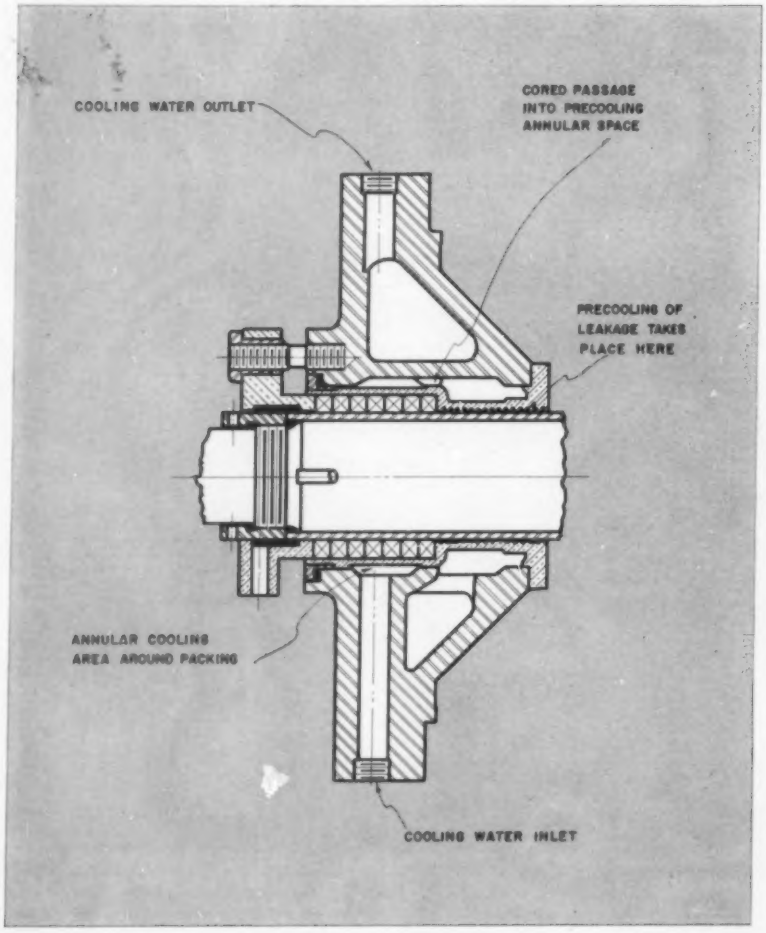

COOLING WATER OUTLET
CORED PASSAGE INTO PRECOOLING ANNULAR SPACE
PRECOOLING OF LEAKAGE TAKES PLACE HERE
ANNULAR COOLING AREA AROUND PACKING
COOLING WATER INLET

Fig. 1. Improved type of stuffing box that operates satisfactorily at 3600 rpm, 400 psi and 400 F. Stuffing box leakage is precooled before it reaches packing

As pressures and temperatures go up, stuffing boxes and their operation become more complex. To get good results, an operator needs to know basic principles behind their construction

By IGOR J. KARASSIK*

THE PROBLEM of packing centrifugal pumps against high pressures and temperatures is one on which there are no definite limits, and the factors affecting stuffing box design and the life of the packing can be listed as follows:

1. Pressure
2. Temperature
3. Rubbing speed
4. Type of packing
5. Shaft sleeve material
6. Range of variations of the above
7. Operating skill and experience

Basically, packing that is placed in a stuffing box is a pressure breakdown device. The packing itself must be somewhat plastic so it can be adjusted for proper operation. It must be of such consistency, however, that it does not break down when absorbing energy and does not damage the rotating shaft sleeve when properly used. Logically, in a breakdown of this nature, energy must be absorbed resulting in a generation of heat, which must be removed either by cold water jacketing, or leakage, or both.

Operation of the stuffing boxes of a boiler feed pump is intimately tied

* Assistant to Vice-President and Consulting Engineer, Harrison Division, Worthington Corporation

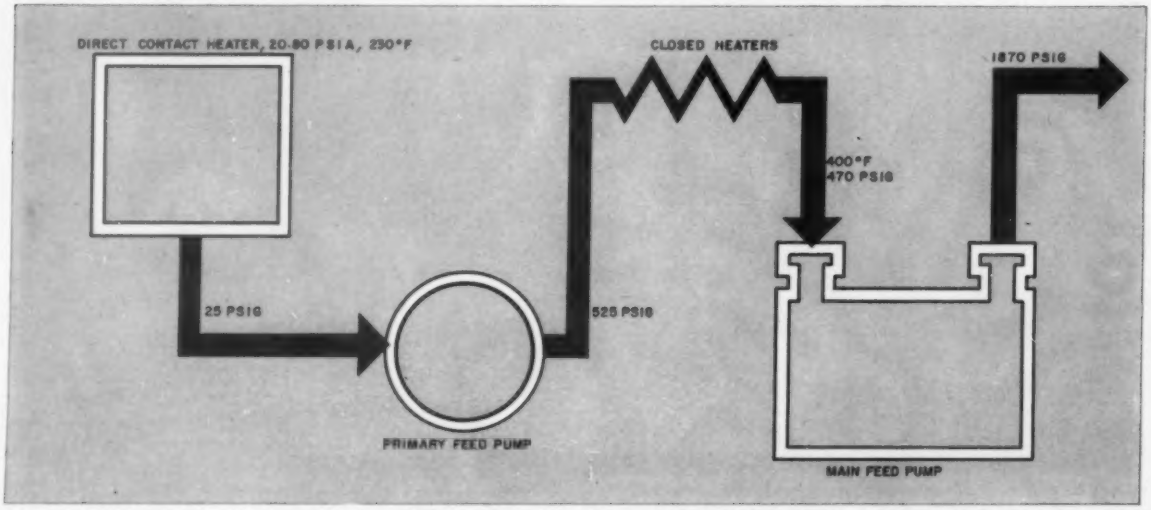


Fig. 2. Split-pumping arrangement in open cycle. Wide variation in stuffing box pressures makes operation difficult

with the feedwater temperature for the following reasons:

(a) All stuffing boxes are operated with a definite amount of leakage, and it is desirable that the temperature of this leakage be brought down to 212 F or below, in order to prevent flashing of the leakage into steam at atmospheric pressure. The initial temperature of the feedwater will therefore determine the amount of heat to be carried away by means of the stuffing box cooling liquid.

(b) Stuffing box packing is definitely affected by the feedwater temperature, and therefore the choice between various types of packing must be dictated by this temperature.

(c) Construction of modern high pressure multistage centrifugal pumps is such that the pressure exerted on the stuffing boxes corresponds to the suction pressure of the pump. Thus for all installations of feed pumps, where the latter take their suction from an open heater, the suction pressure, and therefore the stuffing box pressure, will be governed directly by the feedwater temperature.

Inasmuch as open heaters are seldom operated at temperatures over 350 F, the pressure on a stuffing box will seldom exceed 120 psig plus the pressure corresponding to the submergence between the level in the feedwater heater and the pump center line. However, when the boiler feed cycle is such that no open feedwater is used at the suction of the boiler feed pump and the latter takes its suction either from the condensate pump discharge or from a booster pump, the pressure and temperature at the pump suction, and therefore at the stuffing boxes are no longer linked by any definite relation.

Under such conditions not only may the stuffing box pressure and temperature reach fairly high values, but the pressure may be subject to wide variations, depending on the load at which the pump is operating. The reasons for such a variation are two-fold:

(1) The condensate or booster pump operating in series with the boiler feed pump is generally a constant speed pump and therefore a rise in head takes place between full load and low capacity operation.

(2) Friction losses between the two pumps are considerably reduced with a reduction of capacity.

As a result, it is not uncommon to find up to or even more than 100 per

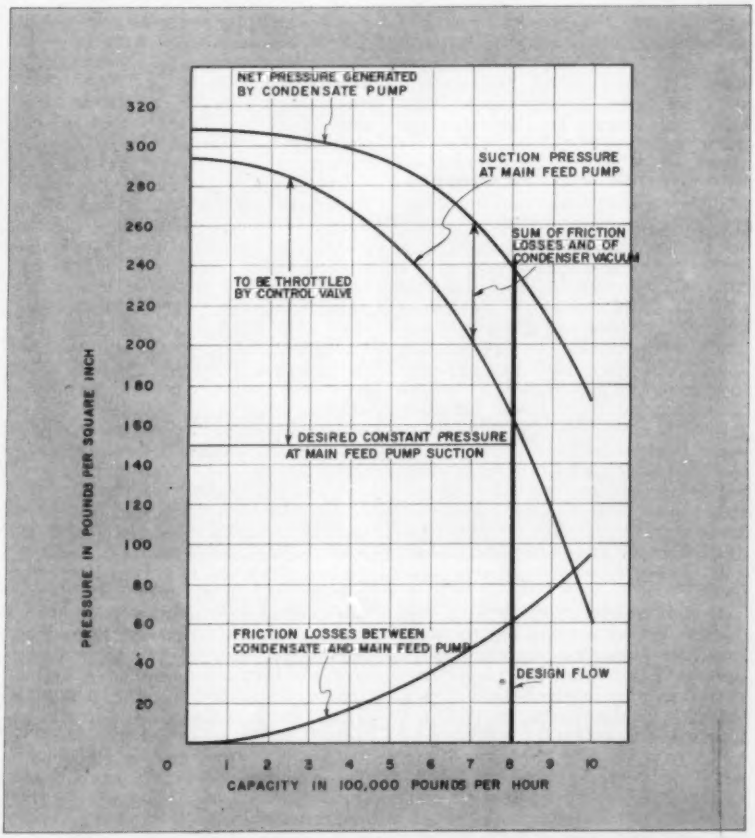


Fig. 3. B-F pump pressure-capacity curves showing effect of installing a control throttling valve in b-f pump suction header to maintain constant suction pressure

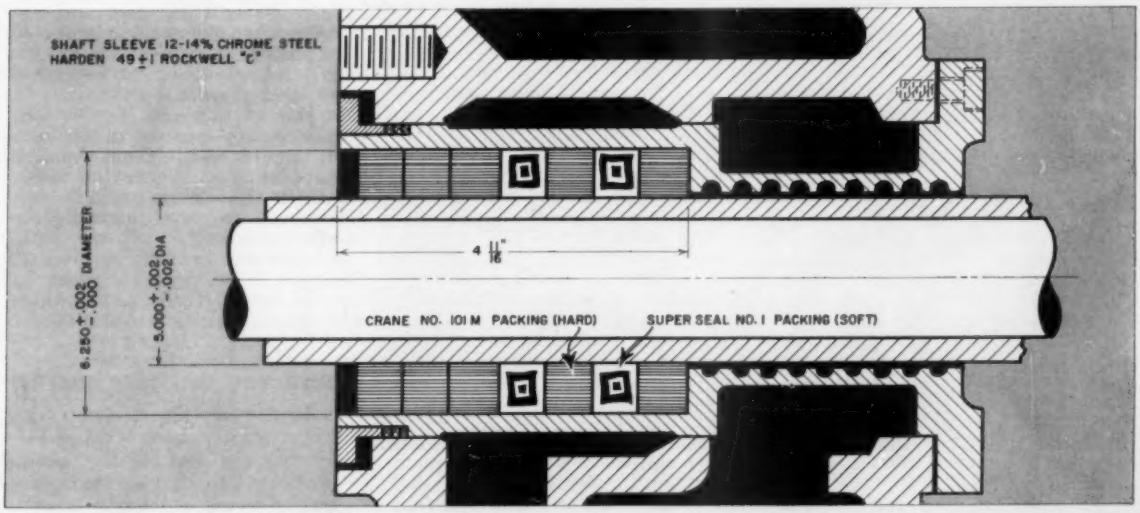

SHAFT SLEEVE 12-14% CHROME STEEL HARDEN 49±1 ROCKWELL "C"
6.250 +.003 -.000 DIAMETER
5.000 +.002 -.002 DIA
4 11/16"
CRANE NO. 101 M PACKING (HARD)
SUPER SEAL NO. 1 PACKING (SOFT)

Fig. 4. Modern stuffing box arrangement for high pressures and temperatures uses combination of hard and soft packing

cent variation in stuffing box pressure between full and no load. For instance, in a typical closed cycle installation where the suction pressure is 160psig and the feedwater temperature is 320 F at full load, suction pressure rises to 350 psig at minimum load.

If this were an open cycle and the pumps were to handle 320 F water at full load, the suction pressure would be approximately 100 psig and would fall to 30 psig at minimum load. The amount of temperature reduction with a decrease in load would, of course, be the same for either cycle.

Bad Effect of Pressure Changes

Such variations are very unfavorable, because if the pressure on the packing varies widely, it is difficult for the packing to reach a set position (that is, at a close running clearance with the shaft sleeve but not in contact with it) as a change in pressure tends to compress or expand the packing. If the glands are adjusted to give the right amount of leakage under normal stuffing box pressure, the packing would be too tight under higher pressures and no leakage or too little leakage will take place. To reduce the effect of pressure changes on the packing requires the use of much harder packings for such conditions which means that on contact with the shaft sleeve more wear takes place.

If the temperature is high, the margin between operating temperature and damaging temperature has decreased. Furthermore, higher temperatures may demand harder packing with less lubricant, which results in greater wear on the shaft sleeve.

There is also the tendency of high temperature water to flash into steam as the pressure breaks down, which not only helps to destroy the packing but also tends to make the operator adjust the stuffing box gland too frequently in an effort to reduce steam at the stuffing box. This frequent adjustment naturally increases the wear on the packing and shaft sleeve and the frequency of replacement.

For these reasons closed feed cycle installations are notoriously more severe on stuffing boxes than open cycles with a deaerator at the pump suction.

Selection Is Difficult

There obviously cannot be a specific combination of conditions such as pressure, temperature, and surface speed which determines a rigid subdivision between satisfactory and unsatisfactory operation of packing. At which point the problem becomes impossible is not possible to state, since each operator has his own criteria for judging the difficulty of the task or the acceptability of the life which he gets from a set of packing.

Thus we can only rely on past experience in selecting the proper stuffing box construction for any given set of conditions. There are not many boiler feed pump installations where the stuffing boxes are packed against really high pressures. However, there are a few, and boiler feed pump manufacturers have learned when we can approach certain limits.

Water Cooled Boxes

For example, with proper water jacketing and cooling (see Fig. 1) it has been possible to satisfactorily pack stuffing boxes operating at 3600 rpm, with a 4 in. sleeve diameter and against 400 psi and 400 F. Cooling water is introduced nearest to the outer portion of the stuffing box.

Before proceeding axially towards the interior of the pump, the cooling water is forced to circulate completely around that portion of the stuffing box which surrounds the packing proper. A cored passage is provided, leading the cooling water from this annular cooling chamber towards the interior of the pump. The cooling water then circulates in a secondary annular chamber which extends into the pump beyond the packing itself, in order to *precool* the stuffing box leakage before it reaches the packing.

After completing this circuit, the cooling water is allowed to leave through a second cored passage which leads to the exit from the stuffing box cooling chamber. In this manner, the coldest cooling water is put into use adjacent to the coldest portion of the leakage and, after having picked up some heat at that point, proceeds inwards into the pump at a higher temperature, but cooling a higher temperature leakage. It should be noted that pre-cooling the leakage before it comes into contact with the packing appears to be the main ingredient of the success of this construction.

Constant Pressure Important

The success of packing boiler feed pumps against pressures as high as 400 psi and temperatures up to 400 F depends very materially upon the existence of a relatively constant suction pressure and requires that the pump be perfectly balanced and operate without vibration at any capacity. In some cases, operation of centrifugal pumps at abnormally light flows increases shaft vibration and is therefore detrimental to good stuffing box performance. The use of stuffing boxes packed against high pressures should be discouraged for such installations as well as for those where suction pressure is subject to wide variations.

Obviously conditions such as are described here can occur only in the case of closed feed cycles or in a "split pumping cycle" where a relatively high pressure booster pump takes its suction from a direct contact heater and delivers it to the main feed pump through a series of closed heaters as shown on Fig. 2. It should be noted that, for a number of sound reasons, this type of arrangement has recently fallen out of favor with steam power plant designers and consequently is a rare occurrence today.

But where such installations exist and where the stuffing box maintenance has been a vexing problem to the operators, means are available to reduce these difficulties to a great extent. We have mentioned that a major source of these difficulties resides in the wide variation in stuffing box pressure.

A control throttling valve can be installed in the boiler feed pump suction header, arranged to maintain a reasonably constant suction pressure. Such a valve can be selected to have a very low pressure drop at full load — down to 15 psi — and its inclusion in the system will therefore not reduce the available pump discharge pressure unduly.

At light loads, the valve will throttle off a pressure corresponding to the sum of the increase in pressure of the pump or pumps ahead of the main feed pump and of the reduction in friction losses between these pumps (see Fig. 3). In such a manner, the suction pressure at the main feed pump and hence the stuffing box pressure will remain constant regardless of load.

Benefit to Regulation

It should be noted that this arrangement will have a beneficial side-effect on the boiler feedwater regulator whenever the feed pumps are operated at constant speed. Normally, the latter must throttle off a very considerable pressure at light loads, because of the increasing difference between the pump discharge pressure and the required system pressure. A portion of this throttling will now devolve upon the control valve at the boiler feed pump suction and the duty of the feedwater regulator will be reduced, with favorable results on its "sensitivity" and maintenance.

It remains to mention that experience has shown that certain packing arrangements are much superior to others when high stuffing box pressures and temperatures are encountered. One particular arrangement (Fig. 4) employs a combination of hard and soft packing. The bottom ring in the box must be of the hard type, to prevent the gland pressure from squeezing it inside the pump interior or the internal pressure from deforming it excessively and reducing its effectiveness.

A future article will discuss pressure breakdown arrangements used to ease the service conditions to which stuffing box packing is subjected.

WOULD YOU LIKE TEAR SHEETS?

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Fig. 1. February '56: rig lifting 10-in. H-beams in place preparatory to driving them to 76-ft. below street level. Two other cranes are equipped with steam-driven hammers and guides. Foundation comprises 422 steel bearing piles in clusters; 210 lighter weight beams as perimeter shoring. Some driven to 85-ft.

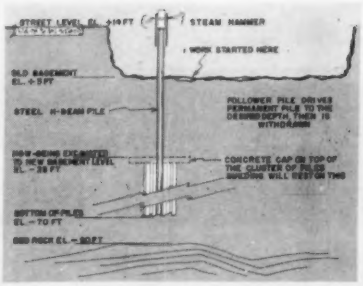

STEAM HAMMER
WORK STARTED HERE
OLD BASEMENT
STEEL H-BEAM PILE
FOLLOWER PILE DRIVES PERMANENT PILE TO THE DESIRED DEPTH, THEN IS WITHDRAWN
CONCRETE CAP ON TOP OF THE CLUSTER OF PILES BUILDING WILL REST ON THIS

Fig. 2. Method used for installing Inland Steel Building's foundation steel piling

Fig. 3. Three Vapor steam generators, located strategically inside the job, furnished power for pile driving. Units developed 200 psi in 2 min from cold

Steam Drives Inland Steel Foundation

FROM OUR office windows on the sixth floor of the Westminster Building in Chicago, the editors of POWER ENGINEERING have been keeping a sharp eye on progress of the Inland Steel Building, Chicago's first all-stainless steel and glass office building, now under construction just across the street from us.

Engineers for the new 19-story, $6,000,000 building chose steel bearing pilings as the most economical foundation method for use on Chicago's unfavorable subsoil conditions. The method eliminates the caisson work formerly used on many of Chicago's buildings. This is the first major construction in the Chicago Loop to be built on steel H-beams. There are nearly 1000 tons of beam piling in the foundation — most of it driven into place by steam.

The job received this power from three Vapor steam generators, model OKJ-4740. Two units were located in the center of the job site, the other at a strategic point along one side. These units each develop 200 psi steam pressure in two minutes from cold water. They can operate at from 75 to 300 psi, but work most efficiently at *continued on page 110*

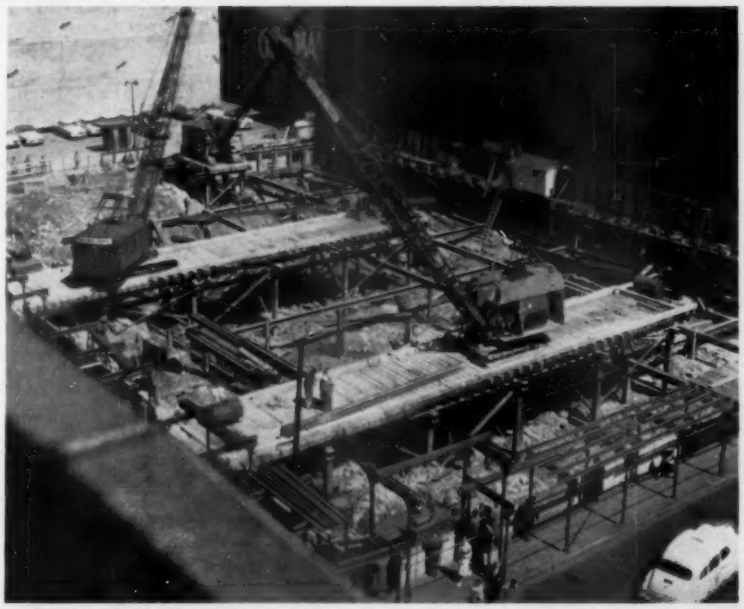


Fig. 4. April '56: Pile driving finished, H-beam cross-bracing is added to hold walls firmly in place while excavating is carried out to a depth of about 35 ft below street. Three steel trestles have been built at street level. Three clamshell cranes work from these platforms. Later, trucks will load from street level

Systematic Records . . .

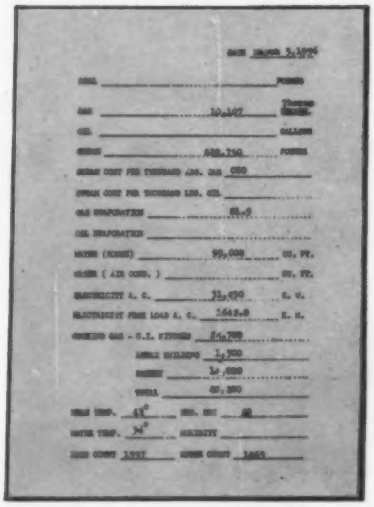
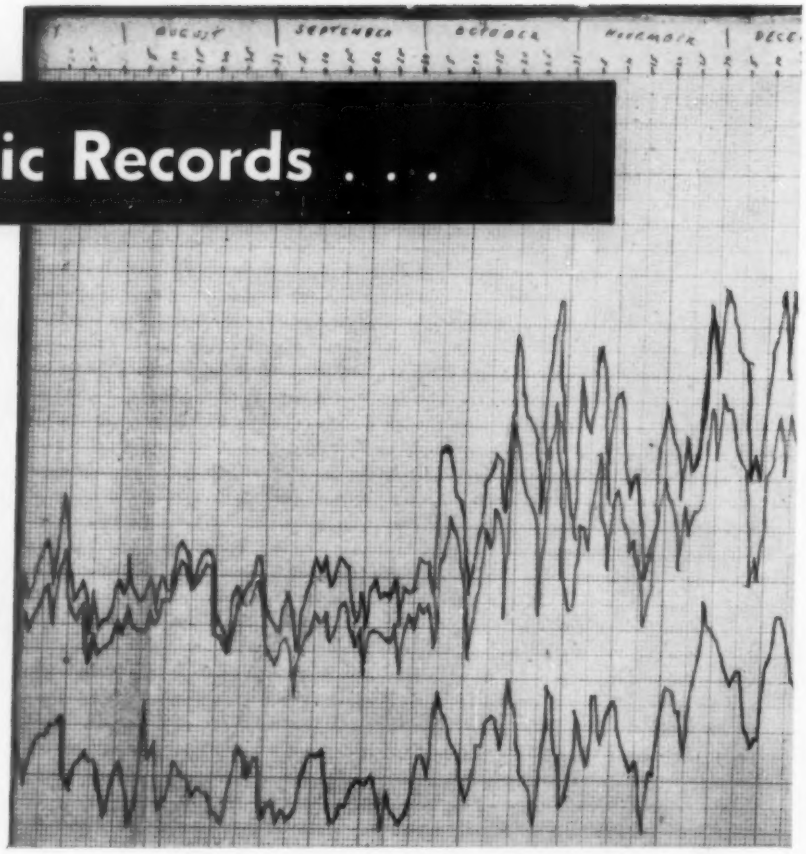


Fig. 1. Meter readings taken every 8 hours from the 3 boilers in Chicago's Hotel Sherman are the basis for this daily report and the graph of Fig. 2



. . . . . the Difference Between Guess and Success in Planning for Power Plant Changes

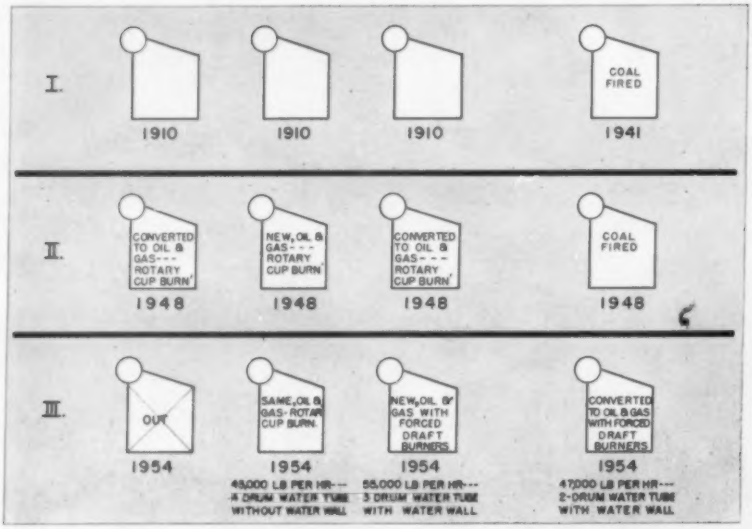


Fig. 4. Evolution of the Hotel Sherman's power plant has had 3 phases. The present line, phase No. 3, has made possible a 10 per cent decrease in the cost of fuel for the plant. The old No. 1 unit (extreme left) was not removed but left standing in its original position. New boiler is the 3-drum unit

EXPERIENCE with a new set-up in the boiler plant at the Hotel Sherman in Chicago proves once again how indispensable are careful records on past performance when the time comes to make changes in a power plant.

Through accurate and detailed records on all operational phases of its boiler plant over a continuous span of years, the Sherman has been able to engineer a 10 per cent rise in boiler efficiency into its system.

The Sherman's plant has been evolving since 1910, as Fig. 4 shows. The third phase of change came in 1954 when one of the original boilers reached the end of its usefulness; a second unit, coal fired, needed conversion to gas and oil; and a new boiler had to be purchased. What, exactly, was needed? What, exactly, was the maximum demand which the system should be engineered to meet? These were naturally the Key questions which governed the situation.

Chief Engineer Glen C. House did not have to fumble or improvise over his answer to these questions. Turning to his daily graph on plant opera-

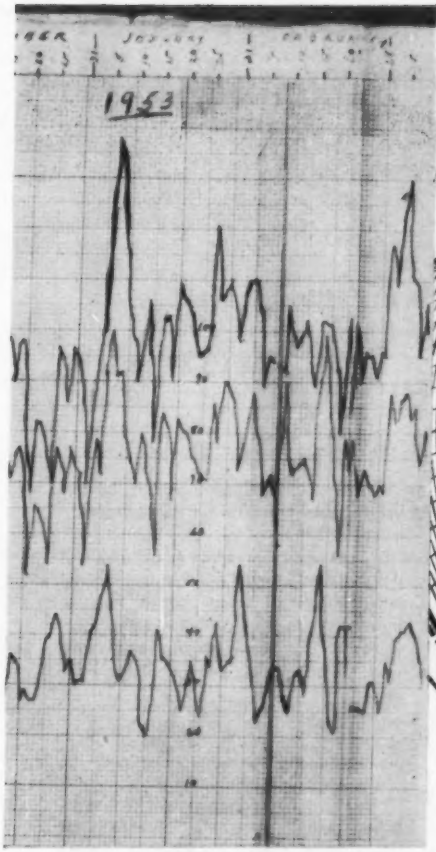


Fig. 2. Portion of over-all operation graph kept daily. Three factors are measured: therms of fuel consumed (gas and/or oil), pounds of steam produced, and degree day. Scale read directly gives degree day (lowest line); multiplied by 100 gives therms reading (upper line); multiplied by 10,000 gives the pounds of steam

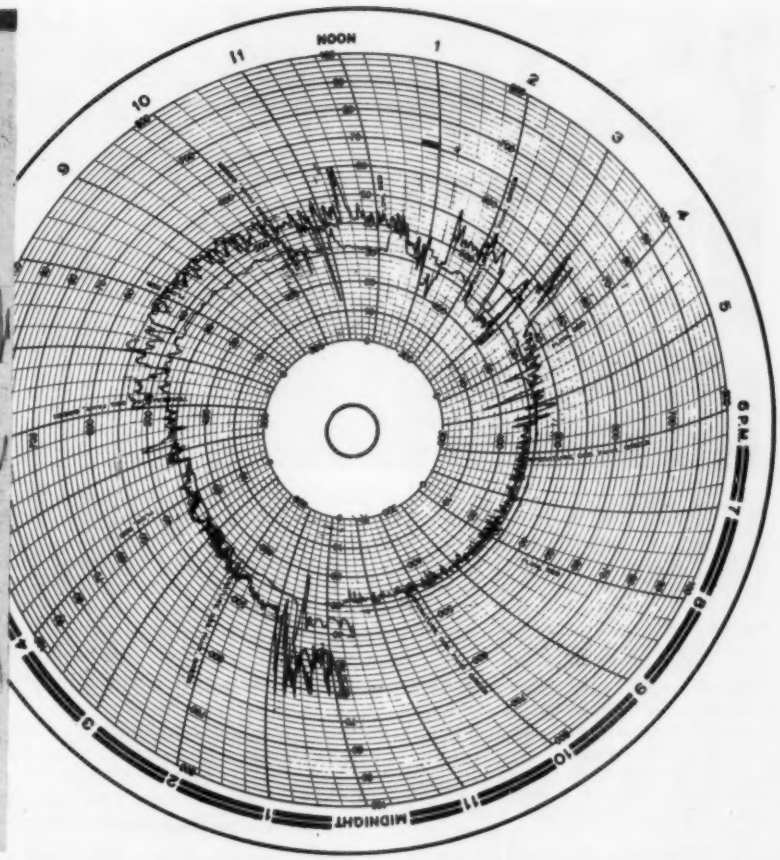


Fig. 3. Typical recorder chart for each of three boilers. Blue line shows combustion air flow; red line, steam flow; green line, boiler exit gas temperature

tions, Fig. 2, he was able to look back over a span of some 6 years of recorded experience. From this vantage point it was an easy matter to spot the exact day on which the system's demand for steam was at peak load, and to use this point-of-fact as the foundation for accurate specifying.

Turning next to his file of detailed daily flow charts, Fig. 3, House was able to determine the maximum hourly need for production on that day. This figure was 80,000 lb. To this, House added a precautionary extra 20 per cent, thus coming up with a total of 100,000 lb of steam per hour as maximum for the system. The new boiler could then be specified with precision to fit into this picture.

In all the work and analysis noted here, House received at all times the full co-operation and support of the hotel management.

As Fig. 4 shows (see also photos next page) the new boiler, which was purchased from Lasker Boiler and Engineering Company, has a capacity of 55,000 lb per hr so that when paired with either of the two existing units, a total output of 100,000 lb per hr is always possible.

Control Equipment

The Sherman's daily flow charts on the performance of each boiler are from instruments mounted on a master control panel, Fig. 5, together with the sub-panels of the Republic combustion controls. A master controller, responding to steam pressure variations, adjusts fuel and air supply to maintain fuel-air ratio for best combustion and constant steam pressure. A furnace draft regulator operates the up-take damper to maintain constant draft. Hagan ring balance meters on the panels record the boiler operating factors shown in Fig. 3.

Gas to Oil, Fast

The Sherman qualifies for the local gas company's cost-saving "interruptible" rate, under which gas is burned most of the time but can be shut off when necessary. To reach top efficiency under this operating condition, the burners selected for the new boiler and for the coal-fired

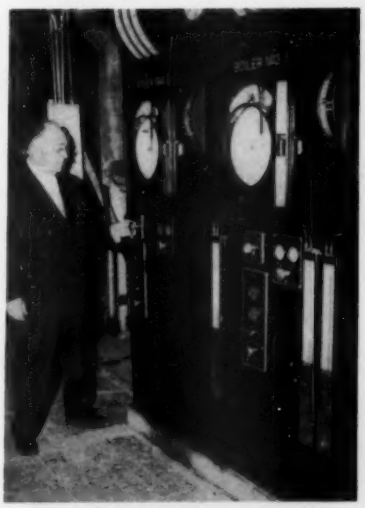
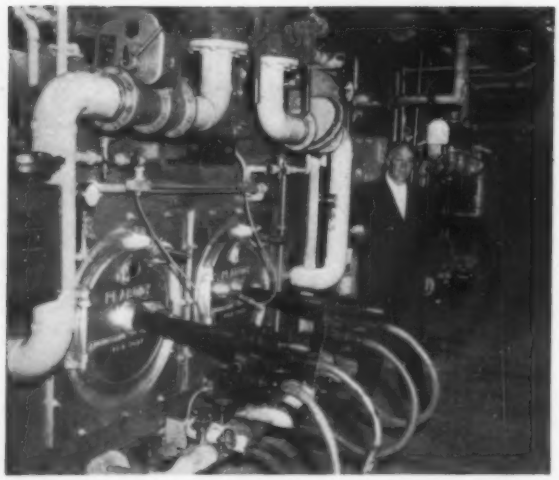


Fig. 5. Chief Engineer Glen C. House at new control panel in Hotel Sherman's boiler room. Meter readings of Fig. 1 are taken here; panel also carries recorders which furnish the charts of Fig. 3



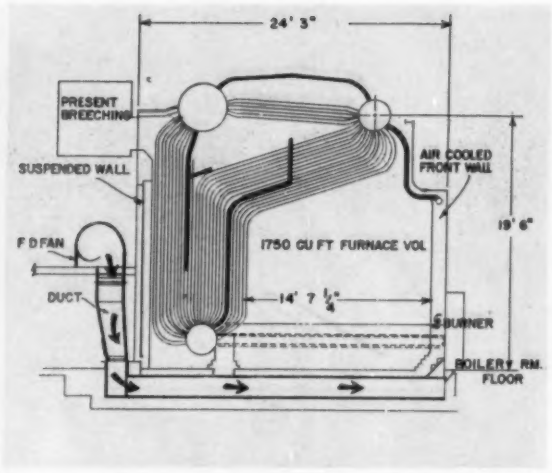


Fig. 6. Chief Engineer House standing between new 55,000-lb-per-hr boiler (foreground) put in the line in 1954 and converted coal-fired boiler (background)

Fig. 7. New unit in Hotel Sherman's plant is Lasker boiler above, of 55,000 lb per hr capacity, operating at 150 psi. Highest efficiency 80.5 per cent on oil, at 37,500 lb per hr output; 81 per cent on gas, at same output. Forced draft fan, located behind unit, blows air under the boiler floor, keeping floor cool and picking up heat for delivery into furnace. This same arrangement was used in principle in conversion of coal-fired unit, the fan being placed at the side

boiler being converted had to have flexibility as their No. 1 characteristic. House chose Peabody forced-draft burners engineered by Enterprise Heat and Power Co., into an installation that gives almost instant change-over from gas to oil, and has proved its capacity to meet the needs of the system.

The change-over is accomplished simply by turning a selector switch on the master control panel and pulling back the oil-atomizing gun. No changes in refractory or piping are required. It is necessary, of course, to shut off oil and steam valves when the time comes to make the change-over.

The new boiler was set with a Detrick suspended-wall enclosure on rear and side walls and an air-cooled front wall.

Combustion air is supplied by a Clarage fan set at the rear of the boiler, Fig. 7.

Cure for Burning Tubes

House worked out an interesting new wrinkle in converting the coal-fired unit to gas and oil firing. This boiler had been giving trouble from burning out of some of the furnace water tubes. The trouble was corrected by the addition of new sidewall feeder tubes, Fig. 8. These new tubes were welded into the head of the mud drum, then stress relieved by heating the whole area. A 2-in. blow-off line was also added to the sidewall headers on each side, to take care of any settling of sludge in the headers.

Steam Distribution

The Sherman plant distributes steam under both high and low pressure: low (5 psi) for heating; high (125 psi) for the large commercial laundry operated by the hotel.

The system employs zeolite-treated water for make-up; a daily check is made on boiler water conditions, and the water is treated accordingly.

The plant sells steam to the Greyhound Bus Terminal across the street. The steam is sold on a flat rate per 1,000 lb of steam used. Billing is based on condensate return meters, and a Hagan steam flow meter is used on the steam supply line as a check.

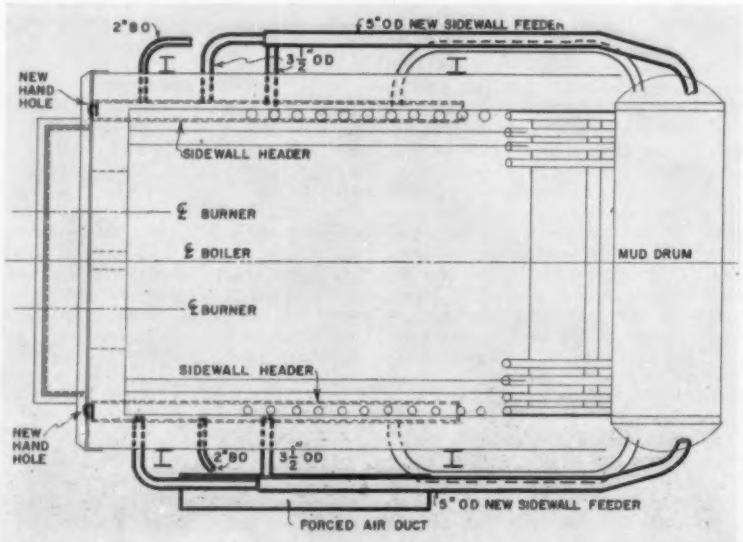


Fig. 8. How new sidewall feeders were added to converted boiler to minimize burning out of tubes. The new 5-in. steel piping (heavy lines) doubles capacity to the sidewall headers and enters the walls at two points on each side, thus equalizing feed to the tubes. A 2-in. blow-off line was also added on each side

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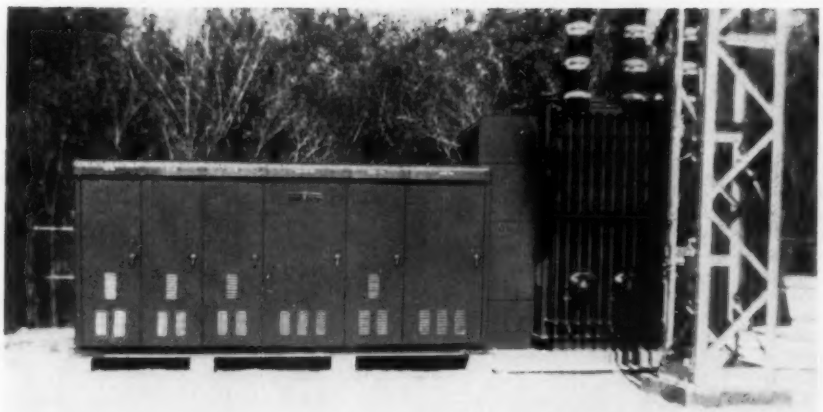

Fig. 1. This three-feeder primary network substation has lightning arrestors mounted on transformer, 34.4–4.36 kv

Converting a Radial to a Primary Network Distribution System

Where there is a possibility that a radial system may have to be converted to a network system, the radial system can be designed to make the changeover simpler. Here the author tells how to do it

By **WARREN W. WALKLEY** *

AN INCREASING NUMBER of electric utilities have been making provision for converting their 4-kv radial distribution systems to future primary network operation. Certain conditions favor the establishing of a primary network system, and the conversion from a radial system can be simplified by expansion through a planned program.

Primary Network vs. Alternative Methods: A primary network system is a means of obtaining improved service continuity by eliminating outages caused by subtransmission or substation failures. Alternative methods of obtaining improved service continuity are: (1) radial system with dual subtransmission sources to each substation, (2) any type system using double-ended substations with secondary throwover, or (3) a radial system with open field-ties between feeders from adjacent single-source radial substations.

The radial system with dual-source substations can provide improved service continuity for outages due to subtransmission failure, but not for a substation failure. While the single-source radial system with open field-ties can provide service with either a subtransmission or substation failure, it can do so only after line crews have opened the feeder circuit breakers at the station where the outage developed, and closed the feeder-tie switches to the adjacent substations.

A double-ended substation will continue to provide service to all of its feeders when a failure of one substation transformer or outage of one subtransmission source occurs. This type of substation requires two independent supplies from the subtransmission system, while only one subtransmission supply is required for each network substation.

A primary network system also eliminates the need for the long express feeders required with large double-ended substations. This results in a reduction in I^2R losses and voltage drop from these feeders.

Planned Expansion: The manner in which the expansion is planned will depend on whether the conversion is expected to occur in the near future, or if the time of conversion is at some later date, or indefinite. In the latter cases, minimum provisions can be made so that future conversion of the unit will be possible without too much difficulty. To make the transition as simple as possible, the radial system should be planned to meet the following requirements:

1. The subtransmission circuits feeding the area should be from the same source, or from sources which do not have appreciable phase-angle differences.

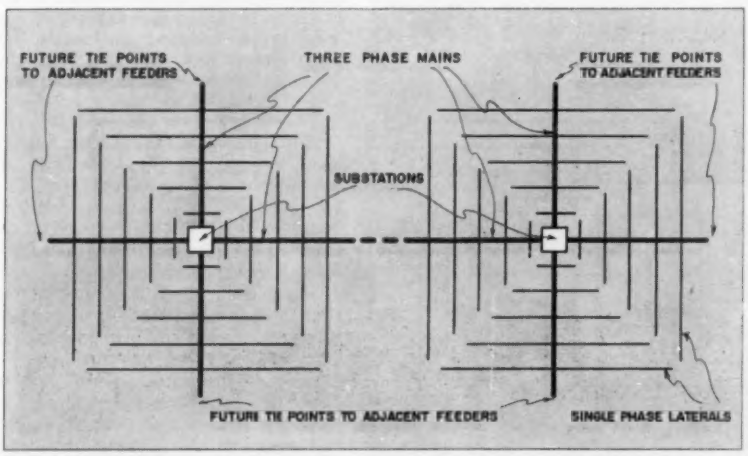
FUTURE TIE POINTS TO ADJACENT FEEDERS
THREE PHASE MAINS
FUTURE TIE POINTS TO ADJACENT FEEDERS
SUBSTATIONS
FUTURE TIE POINTS TO ADJACENT FEEDERS
SINGLE PHASE LATERALS

Fig. 2. The schematic diagram above illustrates a grid-type distribution system

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2. Adjacent substations should be supplied from different subtransmission circuits.

3. The distribution circuit mains should be easily convertible to network tie-feeders, and the 4-kv feeder loading should be limited to values that will permit two feeders to be tied together and fed from either or both ends in the future network.

4. The substations should be easily expandable so that a main breaker, additional feeder compartments, and auxiliary compartments required for network service can be added.

From these requirements, it can be seen that the two distinct areas of planning involved are: (1) subtransmission and distribution circuits, and (2) distribution substations.

Subtransmission and Distribution Circuits: All subtransmission circuits should originate from sources with no appreciable difference in phase angle, so that circulating current and resultant I^2R losses in the system are held to a minimum. As the system grows and additional substations are added, new subtransmission circuits should be brought in so that adjacent stations are not supplied from the same circuit. When a station is out of service, this will permit an equitable division of its load among the adjacent stations and their source circuits.

The distribution circuits must be planned so that condition (3) above may be satisfied. To do this, the first step would be to use the basic circuit pattern illustrated in Fig. 2, and sometimes referred to as a grid. Three-phase mains should be included in the initial stage of development of the system so that a future tie point between adjacent radial feeders is readily available.

A conductor size must be selected for the mains that will be large enough for future network operation at its predicted load density. These conductors must be able to carry emergency and transfer loads without exceeding the maximum permissible voltage drop along the entire length of tie feeder.

Number 4/0 copper, or equivalent aluminum, on a 4160-volt system seems to strike a happy medium between economical loading and structure expense. Since the loads served by the laterals are not affected by the conversion, the lateral conductors and distribution transformers will usually require no change.

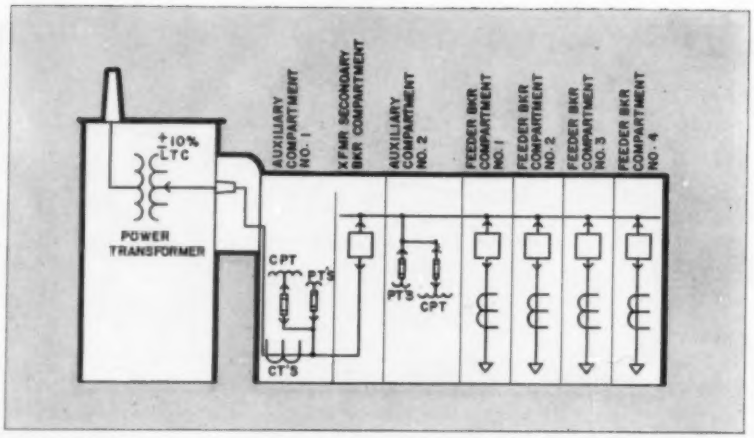

Fig. 3. Shown above is a typical primary network substation with four feeders

Due to the difficulty involved in modifying an existing subtransmission or distribution circuit, it is felt that the same provisions should be made in these circuits in the early stages of planning, whether the anticipated conversion date is in the near future or indefinite.

Distribution Substations: There are numerous factors to be considered in the expansion of the distribution substations before they reach their ultimate stage of development. An outline of a typical four-feeder primary network substation is shown in Fig. 3, and an actual installation is illustrated in Fig. 1.

A study of these figures will reveal that there are four groups of equipment that make up the station, and that each of these may be considered separately. These are: (1) transformer, (2) power circuit breakers and their compartments, (3) control power and instrument transformers and their auxiliary compartments, and (4) necessary network relaying equipment.

Transformers: The transformers to be used with these stations must be of adequate kva capacity to serve the ultimate station load and also have some emergency capabilities to share the additional network load when one subtransmission line or substation is out of service. The additional kva required as the load grows may be provided initially with a transformer having a fan-cooled rating, if conversion is anticipated.

If conversion is indefinite, a self-cooled transformer with provisions for future fan cooling may prove more practical. In either case, the transformer should be equipped with load-tap-changing equipment to provide bus-regulation of the feeders supplied from the substation.

Power Circuit Breakers and Compartments: When selecting power circuit breakers for a radial substation that may be converted to network operation, it is important to provide breakers with adequate interrupting capacity for both initial and ultimate operating conditions. A rule-of-thumb for determining the breaker interrupting capacity necessary is as follows: determine the short-circuit kva available from one distribution substation transformer, and at least double it.

This assumes that the short-circuit contribution from all other substations is equal to that from the immediate substation transformer. This has been found to be true for load densities up to 8000–10,000 kva per square mile, and assuming fairly uniform spacing of substations.

Some electric utilities do not feel that a main transformer secondary breaker is necessary for radial operation, so they do not provide this breaker in the initial layout. A compartment for this breaker should be furnished initially, however, as it is not economically practical to split the metal-clad units apart and insert a new unit in the line-up.

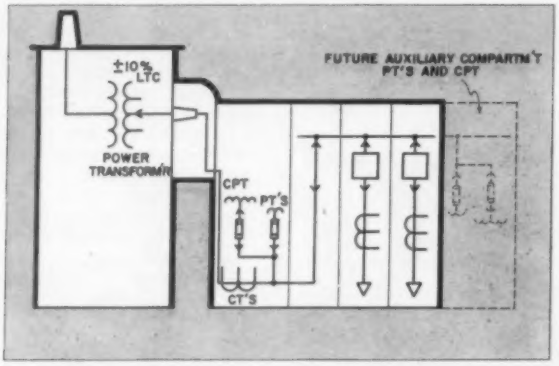

Fig. 4. Diagram shows minimum equipment for two-feeder radial substation suitable for future primary network

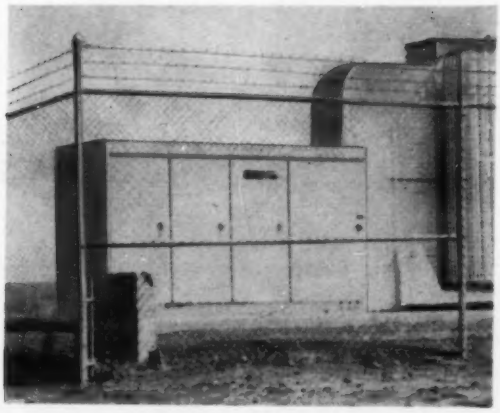

Fig. 5. Photograph showing two-feeder radial future primary network substation with future transformer secondary breaker compartment, rated 13.8–4.16 kv

A dummy removable element is available to make the connection between the main transformer secondary breaker and stationary disconnecting contacts. When the conversion is made, it is a simple matter to lower this device from its connected position, and raise the power circuit breaker in its place. An arrangement of this type is illustrated in Fig. 4.

The number of feeder breakers and compartments to be installed initially is determined by the requirements of the load, but it is hard to justify this type of installation with less than two feeders originally. It is a fairly simple job to add additional feeder breaker compartments onto the end of an existing line-up when required by additional loads; however, the bus must be killed before these compartments can be added.

Control Power and Instrument Transformers and Their Compartments: It is seen from Fig. 3 that there are two auxiliary compartments in a typical network substation, each containing a control power transformer and potential transformers. Auxiliary compartment No. 1 contains three line-ground connected PT's on the transformer secondary for metering and for use with sensitive network relays.

The control power transformer in this compartment is used to supply closing power to the transformer secondary breaker, and for heaters, receptacles, etc. Three CT's are also included in this compartment for metering and back-up relaying. This compartment contains the CPT that supplies closing power for the transformer secondary breaker, and should be located adjacent to the main secondary breaker compartment. This dictates that this compartment be furnished in the initial line-up.

It is recommended that the CPT, PT's and CT's also be furnished with this compartment at this time. In this manner, these connections are already made, and no changes are required when the substation is converted to network operation.

It is felt that the substation equipment so far discussed is the absolute minimum required for a radial substation suitable for future network operation. This is the equipment that would be recommended if the conversion date is indefinite. Fig. 4 shows an outline of a substation of this type, and Fig. 5 illustrates a typical installation.

Auxiliary compartment No. 2 of Fig. 3 also includes three PT's and a CPT. The PT's are for use with the sensitive network relaying equipment, and the CPT is used to supply closing power to the feeder circuit breakers and for heaters, receptacles and lights. These transformers are not necessary until the station is operated as part of the primary network system. It is usual practice to leave these out of the initial equipment and to add them at the same time the transformer secondary breaker is installed.

The auxiliary compartment for housing these transformers may also be supplied at the time of conversion, in which case it will be added to the end of the existing gear as shown in Fig. 4. However, if conversion is anticipated in the near future, it is recommended that the compartment only be included with the initial equipment, as shown in Fig. 6. This plan offers the advantage that the bus does not have to be killed to convert to network operation, and an operating advantage of having all feeders physically together.

Network Relay Panels: The complement of relays required for network operation is mounted on a panel usually located in auxiliary compartment No. 2. The preferred method of providing these relays is to add the panel, with the relays mounted on it, at the time the substation is converted. This expense is thus deferred until the time that the equipment is required.

In a few cases, where conversion is not expected to be too far away, it may prove more convenient to provide a panel in the initial installation that is drilled and wired only. When the conversion is made, it is necessary only to install the relays in the panel and connect them to the wires already provided.

Conclusion: The primary network system offers an economical and dependable method of providing greater reliability of service to areas of fairly uniform load density, which are subject to subtransmission circuit or substation outages. The conversion to a primary network is best accomplished by a planned program of progressive expansion. For a small additional investment in the initial installation of a radial system, it is possible to make provisions for future network operation even though the date of conversion is indefinite.

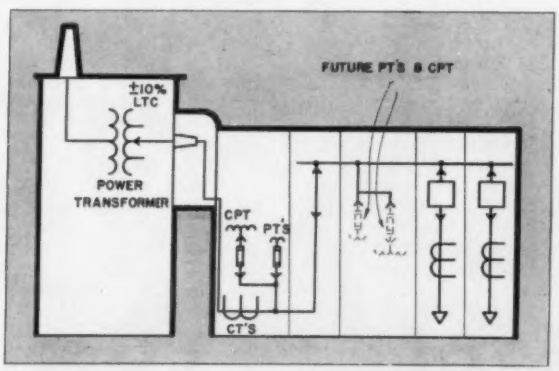

Fig. 6. Recommended arrangement of a radial substation for conversion to a primary network in the near future

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Waste Treatment at Winston-Salem

By L. F. GAFFNEY*

A MODERN manufacturing plant, such as the recently-built Lexington Road Plant of the Western Electric Co., Inc. at Winston-Salem, N. C., demands a chemical waste treatment installation having these characteristics: compactness of design, adequate capacity at peak loads, safety and flexibility of operation, and requiring a minimum of supervision and maintenance.

It was felt by the functional design engineers that a "flow-thru" type of treatment system — one which continuously and automatically treats without storing chemical waste solutions — would best serve these considerations. This selection was made in preference to the "batch" type of treatment system which normally requires large holding basins and additional operating personnel for its three-step method of collection, treatment, and release after treatment of the waste effluents.

The following flows and concentrations of effluents from the metal finishing processes are the peak conditions for which the treatment systems were designed and built:

Acid and Alkaline Wastes
- Normal Flow..... 194 gpm at 3 to 4 pH
- Max. Concentrated Flow.. 500 gal. of 15 per cent H_2SO_4 in ½ hr (1 tank dump daily)

Cyanide-Bearing Wastes
- Normal Flow..... 31 gpm at 3 to 4 ppm
- Max. Concentrated Flows.. 8¾ lb CN in 50 to 75 gal. of H_2O (1 filter rinse per day)
- 9500 ppm in 100 gal. of H_2O (1 tank rinse daily)

Two somewhat similar applications of the "flow-thru" system were utilized, one for the treatment of cyanides and the other for neutralization of acid-alkaline wastes. Basins for both systems were installed side-by-side and below grade for economy of space and construction. Controls and instruments for both systems are mounted in a common enclosure constructed over the covered treatment basins. This enclosure, or treatment equipment building, is finished on the exterior with face brick to match the adjacent manufacturing building.

Acid-proof Construction

The basins themselves are constructed of reinforced concrete with gas-tight manhole covers and frames mounted in the roof to provide access to each treatment cell. All basins are lined with acid-resistant high-density shale brick for floors and walls with tile liner plates used for the roof. An acid-proof membrane, consisting primarily of oxidized asphalt and sulfur, is provided between the acid-resistant brickwork and the concrete structure. Acid-resistant plastic pipe is used to vent the basins to atmosphere above the roof level of the equipment building. All metal surfaces exposed to acid solutions or fumes, such as manhole frames and covers, are coated with a Neoprene-base coating. The 16-in. dia steel reaction cylinder used in the cyanide treatment system (described later) is lined with rigid polyvinyl-chloride plastic sheets to protect surfaces from corrosion. Openings for pipe penetration through liner plates at the roof of the basins are caulked with hot-poured sulfur cement as an acid-resistant sealer.

Duriron Pipe Used

All waste lines penetrating the basin walls, whether carrying untreated influent or treated effluent, consist of Duriron pipe sections, cast in place, with the acid-proof membrane and brickwork carefully fitted around each opening. Concentrated cyanide waste, dilute cyanide waste, and combined acid-alkaline wastes are collected and run in separate acid-resistant Duriron pipes from the metal finishing area in the manufacturing building through an underground trench to their respective treatment basins. The trench itself is lined along the bottom with acid-resistant brick and along the sides with a Neoprene-base acid-proof lining.

A floor drain is installed at the lower end of the trench for drainage in case of a line break or leak. This precaution was necessary because these underground lines carrying chemical wastes run close to the foundation walls and footings of the manufacturing building. Water, compressed air, and electric power services are run in this same trench from the manufacturing building and serve the treatment equipment and control requirements of the equipment building. The treated effluents from both systems are run in ordinary cast-iron pipes into the sanitary sewer system serving the plant in general.

Like most other light manufacturing plants where there is a large amount of fabrication and bench assembly of small precision parts, it is an important consideration that flexibility be built into the treatment systems. One period of operation may require treatment of rinse water from a handful of small parts being silver-plated or a large number of larger parts being anodized. The following period may include the dumping of a tankful of spent acid. The ideal treatment system should operate with efficiency and smoothness even under such varying load conditions. To accomplish this desirable operation, a principle of progressive and immediate dilution of the waste solutions is utilized for both the acid-alkaline and cyanide treatment systems. (See Fig. 1)

Neutralization

The acid-alkaline treatment system consists of a 4000-gal. capacity neutralization basin divided into five 800-gal. cells by baffles, with an electrically-driven mixer provided in each cell. Mixer blades and shafts are rubber-covered to prevent deterioration. The combined acid-alkaline effluents, both concentrated and normal flows, enter by gravity into the first cell of the basin and flow through the intermediate cells to treatment in the last cell of the basin. Intermediate cells and mixers are provided to smooth out expected changes in concentration and contents of the plating waste effluents. This is done to maintain proper control, within the maximum limit of 8 to 8.5 pH, for the treated effluent being discharged to the sanitary sewer system. Total treatment time under peak load conditions is twenty minutes.

Liquid caustic, because of its ease of storage and introduction into the system, is the neutralizing agent used in this system. It is fed into the treatment basin under 2-psig air pressure through an automatic proportioning valve controlled by a pH controller-recorder, sensing neutralization requirements with its immersion-type electrode.

An additional 1000-gal. capacity collection basin and two vertical centrifical pumps were included in this system to utilize the slightly alkaline (8 to 8.5 pH) treated effluent serving a battery of air washers installed in the metal-finishing area ventilation system.

Liquid caustic soda supply for both this system and the cyanide treat-

*Engineer of Plant Organization, Western Electric Co., Inc., New York, N. Y.

Shows You How to Plan System

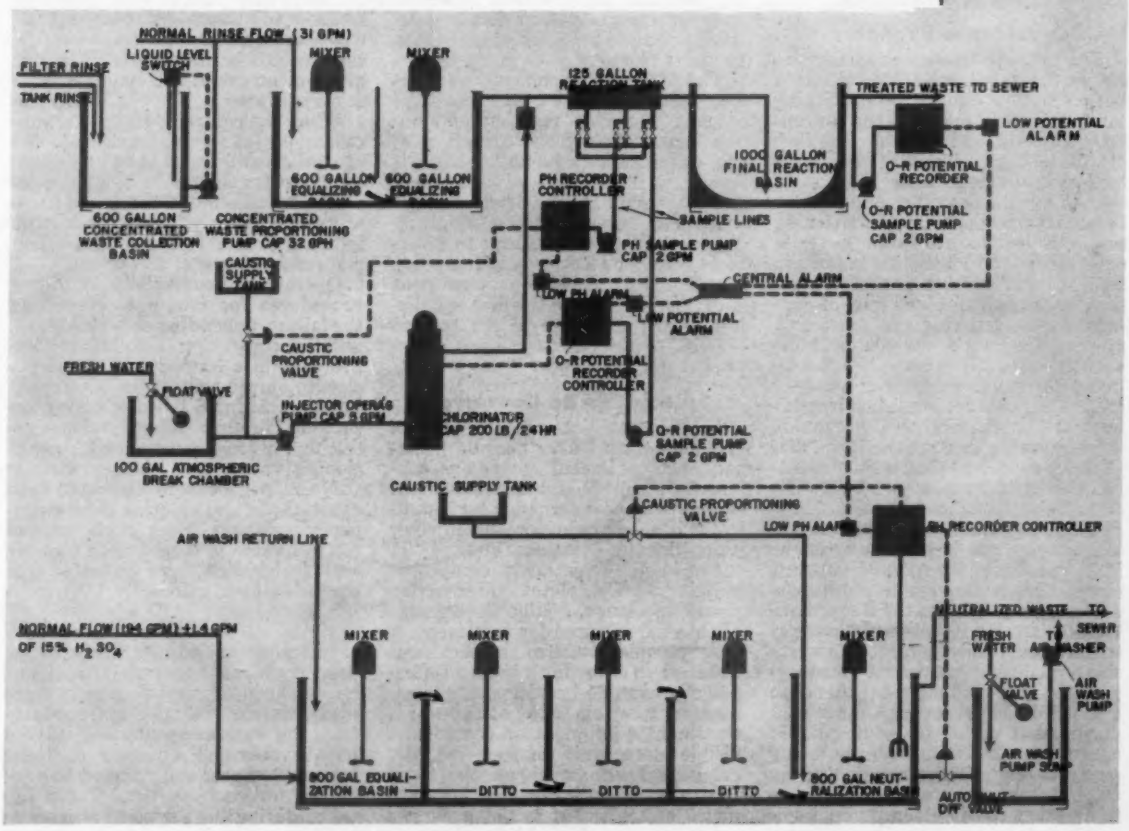

Fig. 1. Flow diagram of cyanide waste and acid-alkaline neutralization treatment systems at Western Electric's new plant

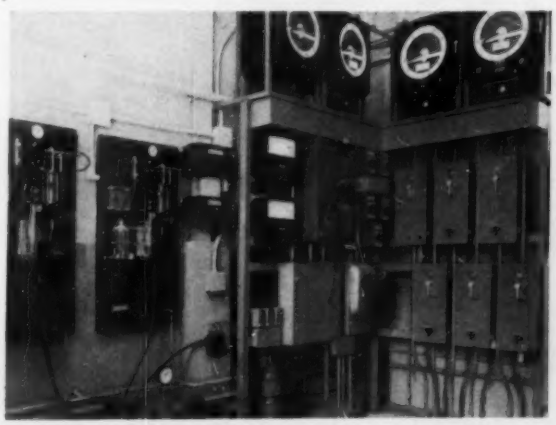

Fig. 2. Main control and instrument rack inside treatment building. Potential-cell assembly on wall at extreme left

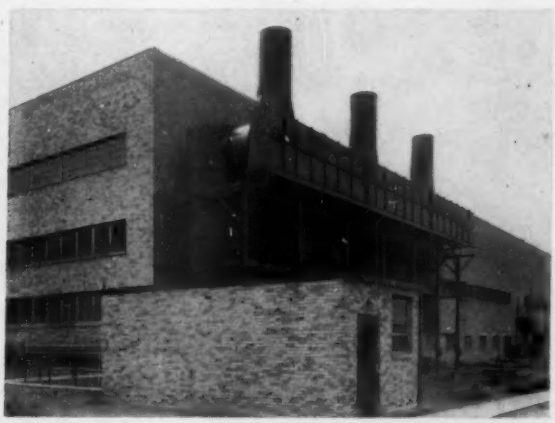

Fig. 3. View of the chemical waste treatment building. Air washers at rear of manufacturing building also show here

ment system is stored underground in two 5000-gal. capacity horizontal steel storage tanks. The liquid caustic is received by tank truck as a 50 per cent concentration and is immediately diluted to 20 per cent concentration by adding water to prevent crystallization during storage. Depending upon the volume of work in the metal finishing area, the storage capacity will hold from one to three months supply of caustic soda.

Cyanides to Cyanates

The cyanide treatment system includes a 600-gal. capacity collection basin and a small proportioning pump to collect and feed the concentrated cyanide effluent into the first of two 600-gal. capacity equalizing basins (provided with mixers to smooth out the normal cyanide wastes before treatment). The proportioning pump is set to discharge by float control the capacity of its collection basin over a 16-hour period. Therefore, constant combined flow of cyanide wastes entering the treatment system for peak periods will be slightly over 31 gpm at approximately 70 ppm.

Treatment is accomplished by adding gaseous chlorine to the cyanide wastes flowing through the 16-in. dia, 125-gal. capacity, plastic-lined steel-reaction cylinder located between the second equalizing basin and the 1000-gal. final-reaction basin. Piping carrying chlorine gas is genuine wrought iron. Feeding of the required amount of chlorine is through a 200-lb-per-day capacity chlorinator under control of an oxidation-reduction potential controller-recorder. The waste solution during treatment must remain on the alkaline side, therefore the pH is kept between 8.5 to 11 during that period by adding liquid caustic to the water supply being pumped through the chlorinator by an injector pump. To avoid contamination the injector pump takes suction from a 100-gal. capacity gravity water tank. The amount of caustic soda is added through a proportioning valve under the control of a pH controller-recorder provided with a flow-type electrode to sense requirements in the 125-gal. reaction cylinder. Sampling pumps of stainless-steel construction are provided with valved connections into the side of the reaction cylinder, to continuously draw samples of the solution to serve both the potential cell assembly and the flow electrodes, sensing elements for the O-R potential and pH controller-recorders respectively. Sample lines are of corrosion-resistant plastic.

The 1000-gal. capacity final reaction basin is provided to receive the effluent from the reaction cylinder and permits complete oxidation of the cyanides to cyanates before it flows into the sanitary sewer system. A separate O-R potential recorder with cell assembly continuously checks the system discharge to determine whether treatment is complete. During peak operation, treatment time from entry into the first equalizing cell to discharge of the treated effluent to the sanitary sewer is approximately one hour.

System Can Be Converted

If the complete destruction of cyanates should ever become necessary, the treatment system as constructed, can be readily converted to meet the new demands by installing another chlorinator and injector pump in the locations allowed for them in the treatment equipment building. Complete destruction would, of course, double the amount of chlorine required for treatment.

A complete alarm system was installed to cover both the acid-alkaline and cyanide-bearing waste treatment systems in case of failure of treatment equipment or controls. A visible alarm unit for each recorder or controller-recorder on the main control rack indicates whether each phase of treatment is being carried out properly. An additional alarm unit gives warning of low chlorine supply by using a pressure switch in the chlorine supply line to the chlorinator. All five individual alarm units are connected into a central alarm unit located near the supervisor's desk in the metal-finishing area of the manufacturing building and gives both visible and audible indications of malfunction in either system.

As an additional emergency measure, a relay has been installed in the alarm circuit for the O-R potential recorder to automatically cut out the concentrated cyanide waste proportioning pump immediately in the event of failure of the cyanide treatment equipment.

When the central alarm gives indication of failure of treatment, the central control board shows a lighted red lamp for the phase, or phases, of treatment affected. Conversely, those units displaying a lighted green lamp indicate proper functioning of their respective phases of treatment.

Operating instructions outlining procedures for manually correcting the failure, depending on which alarm unit is registering the failure, are provided in a framed and glazed enclosure on the wall of the equipment building. Manual by-pass valves are provided around the air pressure reducing stations, caustic soda proportioning valves, and chlorine control valve, to permit hand feeding of both caustic soda and chlorine as an emergency measure. Each such manual control valve is tagged with number and designation, and listed in the operating instructions.

Tests

In order to adjust the systems properly when they were initially put into operation, titration tests were made on samples taken frequently from the wastes entering and leaving both systems. Frequency of these tests have now been reduced to once a day for each system. These are taken during the period of maximum treatment requirements, as a matter of record to verify that each system is functioning properly.

Fig. 4. Interior of treatment building; main control rack is at left. Manhole covers give access to gas-tight basins

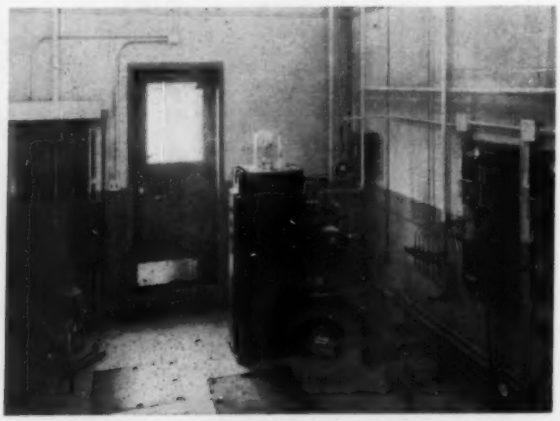

Fig. 5. Another view inside the chemical treatment building. The chlorinator is in the center, sample pumps are at right

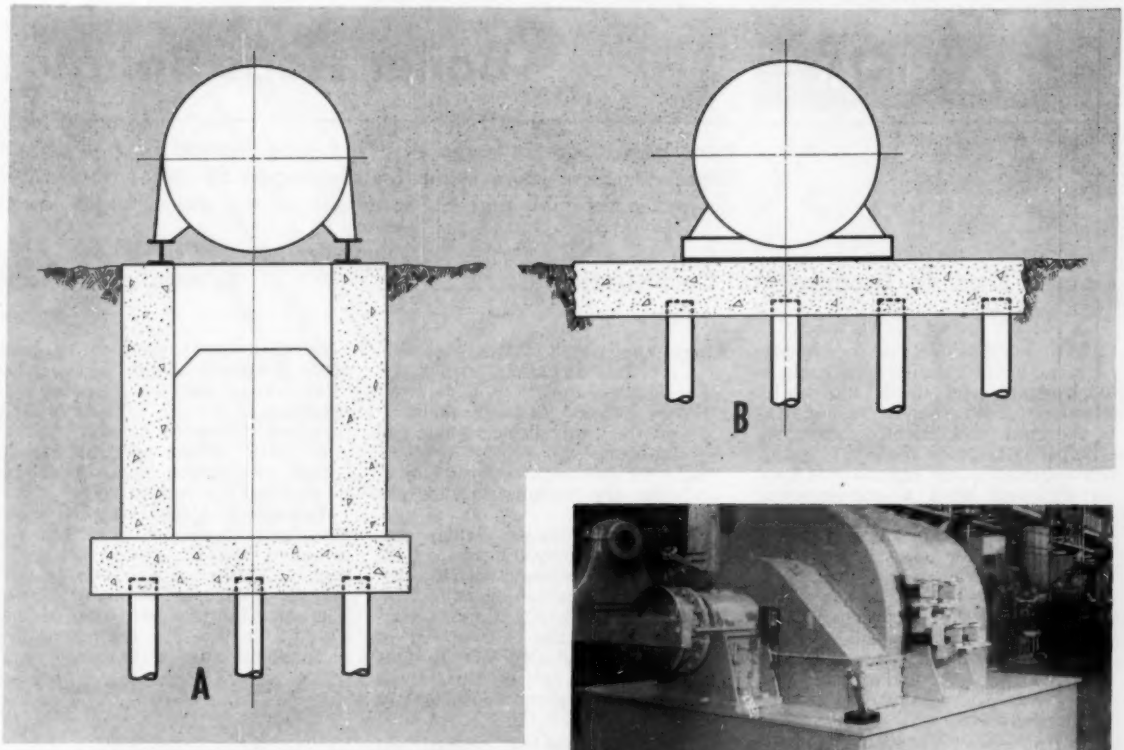

Fig. 1. Small foundation for new motor (B) compared with space for normal unit of comparable size (A)

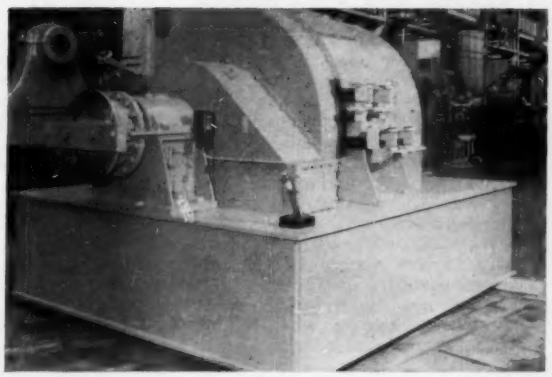

Fig. 2. Right. 1250 hp motor of type described here showing baseplate housing ventilating equipment

New Idea in Rolling Mill Motor Design

Ventilating Equipment in Baseplate Saves Foundation Space

By R. M. DUNAISKI*

SIGNIFICANT REDUCTIONS in steel mill drive costs are made possible by a recent development in motor construction in which the ventilating and cooling equipment is designed as part of the motor baseplate, thus eliminating the need for large foundation construction for external ventilating equipment.

Figure 2 shows one of these motors. It will be seen that the motor is similar to the usual totally enclosed motor of this size, except for the somewhat higher and wider baseplate construction. A very significant difference in appearance, however, is the absence of the motor projection beneath the bottom of the base.

Foundation for this new TEWAC (totally enclosed water air-cooled) requires only a reinforced concrete pad of suitable thickness as shown in Fig. 1 (B). The minimum foundations for an externally ventilated machine of comparable size are shown diagramatically in Fig. 1 (A), which gives an idea of the saving in foundation space obtained with the new construction.

Operation of the ventilating system is roughly as follows:

Air is forced through the system by axial flow blowers located in the motor base at the commutator end of the machine. The air is then dispersed into a cavity in the base at the drive end of the unit. From there the air flows upward through a surface air cooler and into an air shield enveloping the mill end of the machine. Air is then drawn through the machine to the commutator compartment. Here it goes through a bank of air filters which remove the carbon dust before the air reaches the blowers.

Great care has been taken to prevent leakage from the unit, and the mounting and accessibility of cooling and ventilating accessories, including filters, blowers, surface air cooler and recirculating air ducts have been designed for easy maintenance.

A particularly wide use of TEWAC motors is foreseen in areas which cannot readily provide conventional foundations and ventilating systems. Steel mills which are expanding or modernizing are a good example, for the new motor can be used with minimum change in present facilities.

The new design can also be used to good advantage to eliminate the expense of overhead ventilating air ducts. Another possible use of the motor is as a replacement for constructions which in the past involved the commonly used top-mounted surface air cooler blower and filter arrangement.

This type of machine is particularly well suited for applications which involve drives scattered over a large area, and it also offers a solution for those areas plagued with water seepage problems frequently encountered in deep basements located along river and lake shores.

*Large Motor and Generator Dept., General Electric Company

GRAPHICAL

Boiler Heat Balance

Heat balance chart in our April 55 issue showed how to obtain losses due to moisture in the fuel; in August 55 losses due to hydrogen in the fuel, and in September 55 the dry flue gas losses

Losses Due to Incomplete Combustion

By PAUL J. GROGAN*

THE LOSS DUE to incomplete combustion in boiler heat balance work usually refers to that loss due to the presence of carbon monoxide, CO, in the final products of combustion. The percent carbon monoxide in the dry volumetric flue gas analysis may be obtained with a conventional Orsat analyzer.

The typical Orsat analysis determines the volumes of carbon dioxide, oxygen, and carbon monoxide, in that order, by absorption. The gas which remain unabsorbed is assumed to be nitrogen. This assumption may be slightly in error since a more complete gas analysis would undoubtedly show traces of combustible hydrocarbons and even hydrogen.

These additional gases may cause a slightly higher incomplete combustion loss than the methods of this article indicate. The difference is not a large item, however, when related to the total heat content of the fuel.

Smoke and minute raw carbon particles are not evaluated in this loss. Studies have indicated that this loss is again very small in terms of the total energy content of the fuel. Very dense smoke probably contains less than one percent unconsumed carbon.

The loss due to incomplete combustion is not kept to a irreducible minimum in usual power plant practice. Rather, consideration is given to control of the much larger heat balance item of dry gas loss discussed in the Sept. '55 issue of POWER ENGINEERING.

As the dry gas loss is brought into control by reduction and regulation of the amount of excess air, the incomplete combustion loss will become measurable. However, the best performance of a steam generating unit generally requires that fuel be sacrificed via incomplete combustion rather than by heating unnecessarily large volumes of excess air.

The equation for expressing the incomplete combustion loss is:

$$Q_{ic} = C_b \frac{CO}{CO_2 + CO} (14{,}600 - 4{,}400) \text{ Btu/lb. fuel.} \quad [1]$$

Where the terms are as follows:

- C_b = Pounds carbon burned per pound of fuel
- CO = Percent carbon monoxide in the dry volumetric flue gas analysis
- CO_2 = Percent carbon dioxide in the dry volumetric flue gas analysis
- 14,600 = Btu released when one pound of carbon burns to CO_2.
- 4,400 = Btu released when one pound of carbon burns to CO.
- 10,200 = Btu lost to incomplete combustion when one pound of carbon burns to CO. In four significant figures, this loss is sometimes given as 10,160 Btu per pound.

The pounds carbon burned per pound of fuel, C_b, is a property of the fuel with certain modifications for the refuse and fly ash analyses. This item was the subject of an earlier heat balance article appearing in the Feb. '55 issue of POWER ENGINEERING.

It is interesting to note the simple way the CO and CO_2 from the Orsat analysis are related in determining the incomplete combustion loss. The volume of gas evolved in the burning of carbon does not depend upon complete combustion.

Stated more accurately, the moles of carbon-bearing gases are not affected by the degree of complete combustion. Hence, the fraction of partially burned carbon may be stated directly in terms of the incomplete combustion products over the total carbon products, or, $\frac{CO}{CO_2 + CO}$.

The ratio, CO/CO_2, where CO is small in terms of CO_2, is a quick visual check of the amount of fuel carbon being only partially consumed in the combustion process.

Equation [1], above has been represented graphically in the chart accompanying this article. The construction is mathematically exact. However, its use may be further simplified in practice if the percent carbon monoxide is small in relation to the percent carbon dioxide.

In that event, and it happens often, the family of lines representing "CO + CO_2" may be taken as representing only "CO_2." There is little practical difference between "14.0" and "14.1" if the percents carbon dioxide and carbon monoxide should be 14.0 and 0.1, respectively.

Example 1: A coal is burned which contains 0.75 pounds of carbon per pound of fuel. The carbon lost to the refuse and fly ash amounts to 0.01 pounds of carbon per pound of fuel. The carbon burned per pound of fuel, C_b, is 0.74. The dry volumetric flue gas analysis is as follows:

Gas	Percent
CO_2	12.0
CO	0.2
O_2	7.0
N_2	80.8
Total	100.00%

Find the heat loss due to incomplete combustion.

Solution: Enter the chart at A, where pounds carbon burned per pound of fuel equals 0.74. Move vertically until intersecting the line representing 0.2 percent CO in the dry flue gases at point B. Move horizontally until intersecting the line representing 12.2 percent (CO + CO_2) in the dry flue gases at point C. Move vertically, again, to the top scale where the answer at point D is read as 122 Btu per pound. It is interesting to note this is in the range of 1% of the initial fuel energy.

Example 2: Your automobile engine frequently operates on insufficient air. Evaluate the loss due to formation of carbon monoxide if the following data are known: C_b — 0.80, CO — 1.1%, CO_2 — 10.9%. Your solution should indicate 750 Btus lost per pound of fuel. Losses due to incomplete combustion in the typical automotive engine often range from a trace upwards to 20%–25% of the heating value of the fuel.

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REPRINTS

If you want reprints of this chart, forming part of Paul Grogan's graphical heat balance, write to the Editor, or use one of the prepaid postcards elsewhere in this issue. Just write INCOMPLETE COMBUSTION on the card and mail it to us

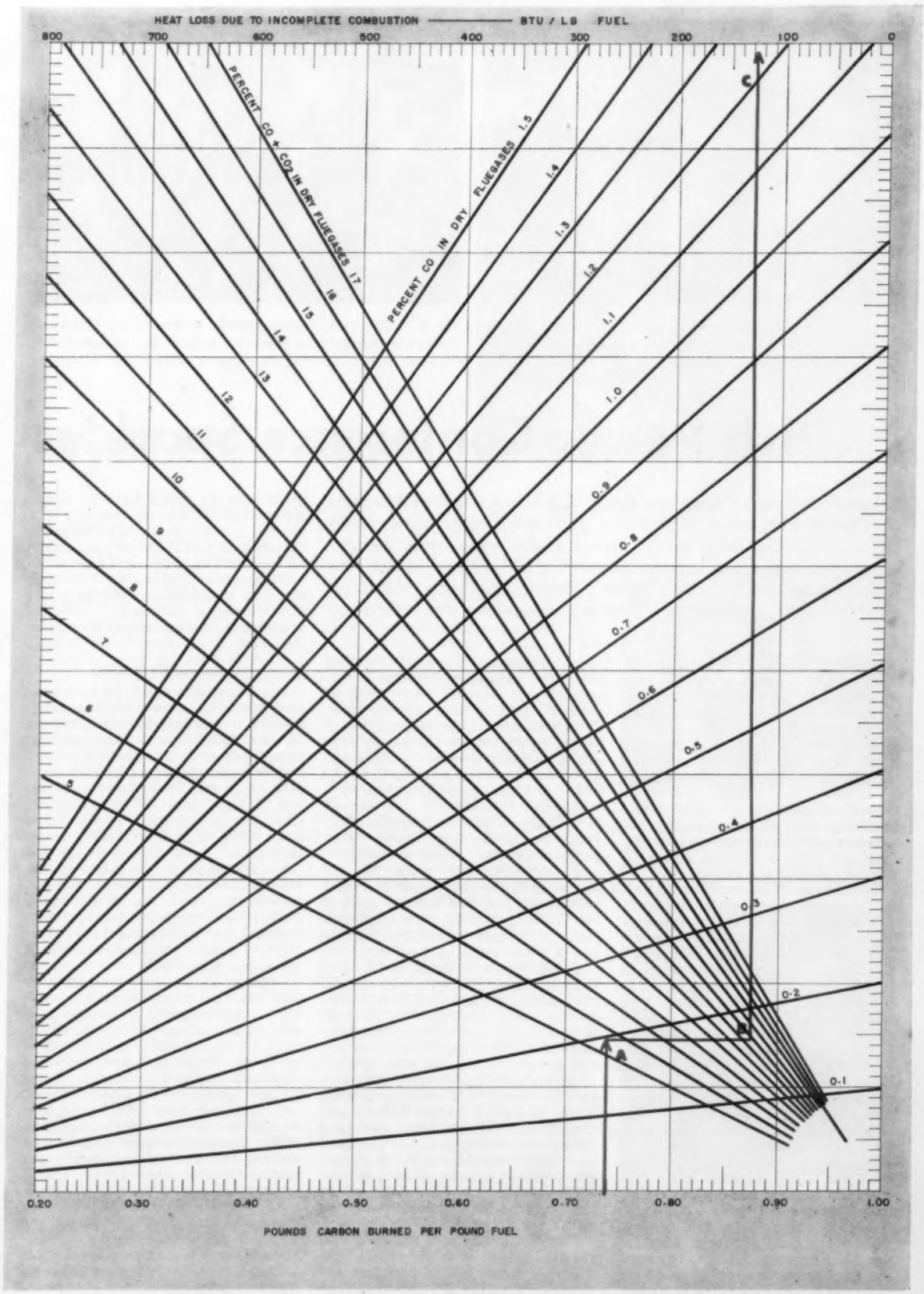

HEAT LOSS DUE TO INCOMPLETE COMBUSTION ——— BTU / LB FUEL
800
700
600
500
400
300
200
100
0
PERCENT CO + CO2 IN DRY FLUEGASES 17
16
15
14
13
12
11
10
9
8
7
6
5
PERCENT CO IN DRY FLUEGASES 1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
C
A
0.20
0.30
0.40
0.50
0.60
0.70
0.80
0.90
1.00
POUNDS CARBON BURNED PER POUND FUEL

Fig. 1. View of grand ballroom at opening session. Addresses were given by R. S. Stevenson, President, Allis-Chalmers Co, and Clarence A. Davis, Undersecretary of the Interior, U. S.

Fig. 2. L to r. H. L. Messerschmidt, Western Elec. Co; M. J. Lantz, Bonneville Power Adm.; D. A. Buck, M.I.T.; and A. W. Kramer, Editor POWER ENGINEERING, examining Cryotrons

18th Power Conference Sparkles

Chicago meeting of American Power Conference included papers on: Combination steam-turbine and gas-turbine plants; new piping ideas; turbine-driven bf pumps; steam washer experience; outdoor industrial power plant; sugar plant power; 225,000-kw central station unit supplying extraction steam to industry; corrosion control; superconductivity; distribution voltage selection; and water technology

REPLETE WITH technical papers bringing out the present developments and future possibilities in the above subjects and many more, and frequently filled with data on what it costs to do these things, the 18th American Power Conference held its annual 3-day session March 21, 22 and 23 at the Hotel Sherman in Chicago. Approximately 3,000 power engineers from all over the country registered for the various sessions and filled the various meeting rooms to capacity to hear the papers.

Comments on outstanding technical papers are given below; all papers will be published in the proceedings of the Conference, available in the near future, and each Conference registrant will receive a copy of it. Director of the Conference is R. A. Budenholzer, and Conference Secretary is E. R. Whitehead, both of Illinois Institute of Technology, Technology Center, Chicago.

In the general opening session, R. S. Stevenson, president of Allis-Chalmers, pointed out that we have about 100 hp for every person gainfully employed, and said that power, the know-how to use it and a favorable political and governmental climate will take this nation and everyone in it to new heights of productivity and prosperity.

John T. Rettaliata, president of Illinois Institute of Technology, at the All Engineers Dinner, reviewed the tremendous contributions of engineering to our expanding economy, and also discussed the need for doing something about the shortage of engineers that has been admitted to exist. He pointed out, however, that all is not despair, for engineering is beginning to attract the better students, perhaps because of the publicity that has been given to the subject in the last two or three years.

Harllee Branch, Jr., president of Edison Electric Institute and President of Georgia Power Company, reviewed the important technical developments made in the power industry by investor-owned electric utilities, and warned against the threat of governmental encroachment in the power industry, regardless of which party is in power.

Other aspects of the same problem were brought out by John Jirgal, chairman of the group on Power Generation and Distribution, Second Hoover Commission. He outlined the position of public power and the federal government in the country's total power supply; discussed price and cost standards in federally generated power and other related factors; and concluded: "Federal power forces are strong and well organized. Compromise with these forces is but a rearguard action leading to final retreat of private industry from the power field, and perhaps of local bodies as well."

One disturbing note intruded into the Conference with the report that a severe rotor failure had just occurred in one of the 160,000-kw turbine generators at the Pittsburg, Calif. plant. Full details of this accident are not yet available but the plant owners and the turbine manufacturer are conducting a detailed investigation, and the Conference was told that this would be made freely available as soon as details had been acquired and conclusions reached as to the cause.

General Problems

High-temperature-high-pressure power generation received the usual attention during the conference. Mitchell and Gaunt of Westinghouse gave a paper on the thermodynamic and economic aspects of super-pressure units, and Fleischmann, Gibeling, Mergy, and Miller of Allis-Chalmers presented a study for a large steam turbine application comparing the use of super-critical and conventional pressures. Based on the calculations made at Allis-Chalmers, it was concluded that a 3500-psig 1050/1050-F cycle is economically justified, but a 3500-psig 1150/1050-F cycle is not — at least, at today's estimated price levels.

Metals for the high temperatures now being considered present a problem to the designers. Foley and Wilson of International Nickel, and Curran and Rankin of General Electric spoke on this subject and predicted eventual solutions of alloy problems. It was pointed out that alloys cannot be developed merely by application of logic or reason; such metallurgical difficulties are overcome only by persistent trial-and-error experimentation.

Steam Plus Gas Turbine

A promising development for the future lies in the combined steam-gas turbine cycle and two papers dealt with this; John Mann of General Electric considered the thermody-

Fig. 3. Participants in water technology symposium on corrosion. L to r. H. A. Grabowski, P. B. Place, L. P. Sudrabin, W. Z. Friend, R. C. Adams, and M. D. Baker, chairman

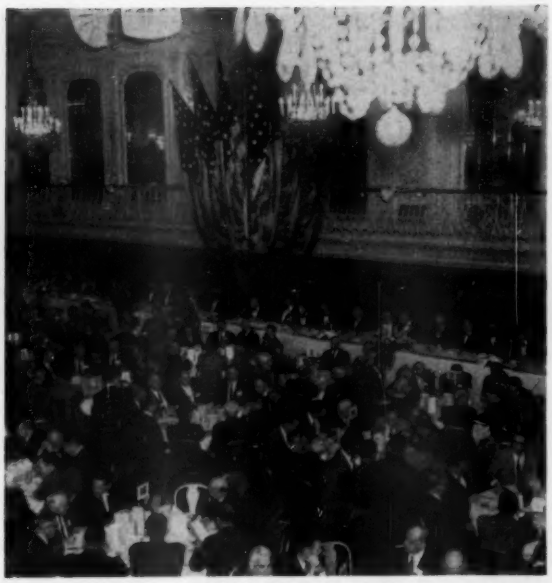


Fig. 4. Part of the grand ballroom during the All Engineers Dinner. A closed television system was used to relay speeches to the overflow lobbies

With New Ideas

namic characteristics of that cycle and showed its greater fuel-saving possibilities over the reheat steam cycle. Daman and Zoschak of Foster Wheeler Corp. contributed to the subject with an evaluation of the supercharged boiler, which, they are convinced, will play an important part in the future of steam generation in combination with the gas turbine.

Another valuable asset of the gas turbine is its suitability for use in peak load generation in a large utility system. W. D. Marsh, GE, discussed a method of analyzing the economics of low cost peaking units. He showed that gas turbines in such service combine the advantages of low investment with ideal characteristics for peak load operation.

Feedwater Heaters

Design aspects of high-pressure feedwater heaters were presented by West of Foster Wheeler Corp. in an interesting paper. The present-day maximum operating temperature in feedwater heaters is about 900 F due to limitations on turbine throttle temperatures. Further increases in throttle temperatures will undoubtedly be in small increments and will not seriously affect extraction temperatures. On the other hand, throttle pressures at, and above, critical pressure result in much higher boiler feed pump pressures. Feedwater heaters designed for such higher boiler feed pump discharge pressures may require special study in the selection of design and choice of materials. The use of a booster pump, with heaters in the intermediate pressure zone, results in feedwater heater pressure well within present practice.

BF Pump Drives

Mellor, Pace, and Ransom of GE gave the results of an investigation into the economics of turbine drives for boiler feed pumps. They concluded, in general, that the investment for turbine drives is greater than for motor drives unless a full-capacity turbine drive with no spare is used, and that there is no justification for using more than two turbine-driven pumps per generating unit since the cost of three half-size turbines is about equal to that of two full-size turbine drives and a better station heat rate can be obtained by using the larger turbine.

Tillinghast of American Gas & Electric, on the other hand, presented the thinking of his company in regard to application of a single turbine-driven feed pump per unit for the 225,000-kw generating unit installations at the Glen Lyn, Muskingum River, Kammer, and Clinch River Plants. It is believed that by careful attention to design, instrumentation, and control, a single turbine-driven boiler feed pump installation has been achieved which will reduce initial investment per net kw of plant capability without sacrificing reliability.

Evolution of fluid drives for producing variable speeds of boiler feed pumps, and their present application in connection with main turbine drive, was reviewed by Ragland, O'Neil and Habicht of American Blower Corp.

In recent months, for the very high-pressure high-temperature plants, boiler feed pump power has increased from less than 1 per cent of main turbine output to 2.5 to 4 per cent. Consequently, their drivers may be of several thousand horsepower capacity, and there is a trend toward driving them with steam turbines.

Latest development, detailed and illustrated in POWER ENGINEERING, April 1956, page 103, is the drive for the world's largest boiler feed pump to date. This pump requires 12,000 hp

Fig. 5. Before the All Engineers Dinner. L to r. Eugene O'Brien, who presided; John T. Rettaliata, President I.I.T. the dinner speaker, and James D. Cunningham, President of Republic Flow Meters

Fig. 6. Speakers and chairman at the transmission systems session. L to r. H. W. Collins, Detroit Edison Company; G. E. Adams, General Electric Co, with Eric T. B. Gross, Power Systems Engrg., Illinois Institute of Technology

Fig. 7. L to r. R. Shumaker, Cleveland Illum & Eng; H. L. Solberg, Head, School of Mech. Eng. Purdue Univ; R. C. King, Assoc. Prof. N. Y. Univ.

Fig. 8. Left, A. E. Beardmore, Application Engineer, General Electric Co; right, L. B. LeVesconte, Electrical Engineer, of the firm of Sargent & Lundy

Fig. 9. L to r. John I. Yellott, Asst. Dir. Stanford Research Inst; P. R. Broadley and W. M. Meyer, both of Locomotive Development Committee, B.C.R.

and it is being designed to be driven directly, through a fluid coupling, on the generator end of a large main turbine generator unit. The paper gave economic analysis of various types of drives for this feed pump, showing that direct main-unit drive was most economical. Of course, a single motor-driven spare must be provided; but the above main-unit drive greatly reduces auxiliary electrical equipment and costs, results in increased net output of main unit and improves heat balance. Another idea suggested was that, on a cross-compound unit, one boiler feed pump could be direct driven by each of the two elements.

Steam Washers

A notable feature of the water technology series of papers was the talks by Friedle of Dow Chemical, and Coulter of Babcock & Wilcox on the recently developed steam washers. Friedle gave the results of full-scale tests and performance of steam washers supplied by Babcock & Wilcox. Coulter told of their theory and development. Steam washers operate to remove silica carry-over and prevent its deposition on turbine blades — a problem that besets high-pressure boiler operators.

In steam washing, silica-laden steam is intimately contacted with relatively pure wash water — such as condensate or feedwater — and silica is absorbed from the steam by the wash water. Friedle, of Dow Chemical, described his experience with steam washing at their South Power Station and expressed his conviction that sizable amounts of money had been saved by their use in maintaining turbine output and decreasing steam consumption of auxiliaries. There were, in addition, he stated, intangible savings due to lower maintenance requirements on turbines and other auxiliaries. This is a development that bears watching.

Piping Problems

Present trend of central-station development to larger units for higher pressures and temperatures has intensified the problem of securing the right piping. Taking a close look at the situation for carbon and low-alloy ferritic steels, Frank A. Ritchings and Sabin Crocker, both of Ebasco Services of New York, report that the ranges of diameters, wall thicknesses and lengths available in seamless piping today are by no means adequate to cover central station requirements.

They drew attention to the high quality and usefulness of the electric-fusion-welded plate pipe and headers made in plate shops to the ASTM Specification A155. This light to medium wall material has been used for "hot" and "cold" reheat piping in central stations in diameters of 16 to 24 in. and wall thicknesses of ½ to 1½ in.

The equivalent of A155 is being made by two of the principal boiler manufacturers for use as furnace wall and superheater headers, and is offered for sale as pipe in thicknesses suitable for main steam and boiler feed systems.

Ritchings and Crocker came forward with these suggestions for ways to use electric-fusion-welded pipe in helping to meet the central station need at this time: (1) as reheat or similar weight piping, possibly using seamless or gorged elbows instead of pipe bends where expansion stresses are particularly severe; (2) high-pressure boiler-feed piping beyond the scope of seamless pipe (except the forged-and-bored type) using forged fittings instead of pipe bends; (3) high-pressure high-temperature main steam lines where the pipe is placed in straight runs not subject to high bending moments.

Black Liquor

Edward J. Martin, associate chief engineer for Proctor & Gamble, described the power plant for the new Foley Mill for the manufacture of high grade wood pulp. Located 60 miles southeast of Tallahassee, Florida, this plant is of the outdoor type and is unique in that it not only supplies steam and power but also functions as a chemical recovery system.

By evaporation and burning it gets rid of the black liquor made in the digesters; reclaims most of the chemicals contained in the black liquor; prepares new make-up chemicals. Also, all the bark produced in the debarking operations is burned in a special 2-drum, type VU Combustion Engineering bark-and oil-burning unit having a capacity of 140,000 lb per hr when burning the maximum rate of bark containing 50 per cent moisture.

Largest single unit of the recovery system is a Babcock & Wilcox boiler rated at 413 standard tons, which produces 220,000 lb of steam per hour as a by-product of the recovery operation.

Prevention of heavy depositions of chemicals and ash in the boiler passes and on the tubes is a vital and practically continuous operation at this plant. To do this job, Foley uses 20 retractable Diamond soot blowers.

A second instance where the power plant is called upon to function as

Figs. 10 and 11. (Left) Exec. Editor Chester Earle of POWER ENGINEERING seems to enjoy handing out attendance prize to S. F. Whirl in our suite at Sherman. (Right) Assoc. Ed. Hagenmiller and another winner prove "numbers game" pays off

Fig. 12. E. E. Williams, vice-president, Duke Power Co, was chairman of the fuels session at which papers were read on the economics of coal buying methods

Fig. 13. Panel members for the nuclear energy forum. L to r. W. Kenneth Davis, AEC; Chauncey Starr, N. Amer. Aviation; C. J. Haugh, Travelers Insurance Co; W. F. Libby, AEC; F. K. McCune, G. E. Co; Chairman R. D. Maxson, Com. Ed. Co.

part of an industrial process was provided in a description of the Vancouver cane sugar refinery of the British Columbia Sugar Refining Co. This was detailed by Gordon Lewis.

The primary steam demand in the process at Vancouver is for boiling the sugar, a step in which water is evaporated and sugar crystals formed; but there are also many other miscellaneous steam requirements connected with the process.

Generally, electricity for an industrial plant can be obtained at the most favorable rate from a utility company. But in sugar refining, exhaust from turbine generators can be used for boiling sugar. So the Vancouver plant includes two 1000-kw Westinghouse turbine generators, 3600 rpm, exhausting at 30 psi.

Vancouver uses two B&W type-G integral furnace boilers with water walls, economizers, superheaters, coal stokers and oil burners.

In an operation of this kind, sugar in the boilers can be a major problem, since sugar causes boiler water pH to drop, and is hard on gaskets. Lewis' discussion furnished a full explanation of how this problem has been dealt with at the Vancouver plant.

New Linden Station

Design of the Public Service Electric & Gas Co's new 2-unit generating station at Linden, N. J., is of interest for the high economy of operation which is being engineered into it, without increasing steam conditions. This is being done by the installation of large units and by taking unusual advantage of the low-level heat energy usually rejected to condenser cooling water.

At Linden, steam extracted from the main turbine is supplied to a nearby oil refinery, which supplies the station with fuels, while the station's electrical output goes both to the refinery and the Public Service system.

F. P. Fairchild, the company's chief electrical engineer, rates the turbine of Linden's first unit as a record-breaking machine on at least two counts. The throttle steam flow of 2,800,000 lb per hr, which corresponds to a rating of 425,000 kw in a straight condensing, conventional reheat machine will be the largest in the world when this unit begins operation in 1957. The rating of 225,000 kw will make it the largest double-automatic-extraction turbine ever built.

Linden's arrangement of three boilers (of the radiant type) supplying one turbine, which is unusual today, was chosen with reliability of steam supply in mind. Two boilers are sufficient to operate the unit with full extraction flow from the turbine.

There are two complete fuel oil systems, one to burn high viscosity fuel, the other to burn Bunker C. The boilers are also designed to facilitate a change-over to slag-tap furnaces, if desired in the future.

Because of the high make-up required, a rather extensive water treating plant is installed.

Evaluation of experience in switching from localized to central control for a 3-unit boiler installation was given by three engineers from the Corn Products Refining Co.: G. E. Hoff, D. S. Hagen and L. C. Laird.

Central Control

One of the most satisfying results after 1½ years of central control has been that the boiler operators now have a feeling of confidence, since they now see clearly the effects of control actions. Also, operator training time has been reduced.

Added psychological advantages have come from air conditioning the central control room, lighting it well, reducing equipment noises to a minimum, and using color schemes to blend into a pleasing atmosphere. All of this has instilled a feeling of pride within the operating group.

Cathodic *continued on page 102*

Fig. 14. John T. Rettaliata, president of I.I.T. was after-dinner speaker at well-attended All Engineers Dinner

Fig. 15. L. C. McCabe, president, Resources Research Inc. delivering his paper on SO_2 as an air contaminant

Fig. 16. J. M. West, Foster Wheeler Corp, delivering his paper on design of high-pressure feedwater heaters

Power Engineering handbook

Cut Good Gears on a Shaping Machine

By F. E. RILEY

IT IS ALWAYS best to obtain replacement spur gears (as well as other replacement parts) from the original equipment supplier. Unfortunately, it is not always possible. Old equipment may have been made by a company now extinct, or delivery of spare parts may take longer than you wish to wait.

Occasionally, therefore, it is necessary to make a special gear quickly in one's own shop. One very simple method of doing this is to use a circular cutter of a form that will give an approximately correct shape to the tooth spaces. This cutter is mounted on the arbor of a horizontal milling machine and the gear blank goes on a dividing head for proper positioning of the teeth. The standard cutter will not produce a quiet-running gear which can be heavily loaded at high speeds, however, because the standard cutter cannot make the varied tooth contours required for varying pitch circles.

Better accuracy can be obtained by using a cutter shaped to conform to a basic rack tooth for the given tooth size. All gears with a diametral pitch of 4, for example, will mesh perfectly with a rack with teeth of diametral pitch 4, and the rack teeth will have straight sides. It is, therefore, relatively simple to originate spur gear teeth with perfect involute curves; merely use a cutter with the straight-sided rack tooth size and shape to make the tooth spaces in the gear blank.

One way to use the basic rack tooth form in gear cutting is to use a spiral hob and rotate the gear blank in mesh with this. Another method is to make a short piece of rack, or only one tooth from the desired rack, of tool stock and reciprocate this parallel to the gear axis while the gear rolls along it. The single-point tool will probably be preferred for infrequent jobs.

Figure 1 illustrates the principle in sketches (a), (b) and (c). The single-point tool (A) is shaped and ground to the dimensions of a single rack tooth. The gear blank (B) rolls in the direction of the arrow (C) and at the same time moves horizontally in the direction indicated by arrow (D). The tool is engaging in sketch (a), is over the gear axis and has finished one flank of the tooth in sketch (b), and has finished the tooth space in sketch (c).

It can be seen that a standard horizontal shaping machine can reciprocate the cutting tool properly. If the machine is modified slightly and a universal dividing head as used in spiral milling machine work is fitted to the machine table, then the rolling action can be obtained for the gear blank. One further requirement is the indexing of the blank between tooth spaces; this is obtained by using the normal dividing means fitted to the standard universal dividing head.

The set-up is shown schematically in Fig. 2. The shaping tool is at (A) and the gear blank at (B). The blank is mounted on a true mandrel secured to

fold along this line—outside edges toward you

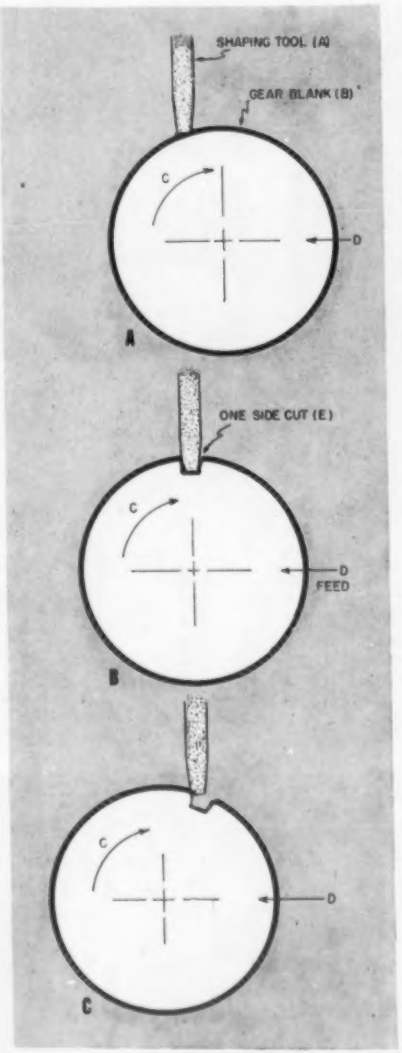


Fig. 1. How straight-sided rack tooth tool cuts involute tooth in rotating gear blank. Tool reciprocates vertical to page, blank feeds past it

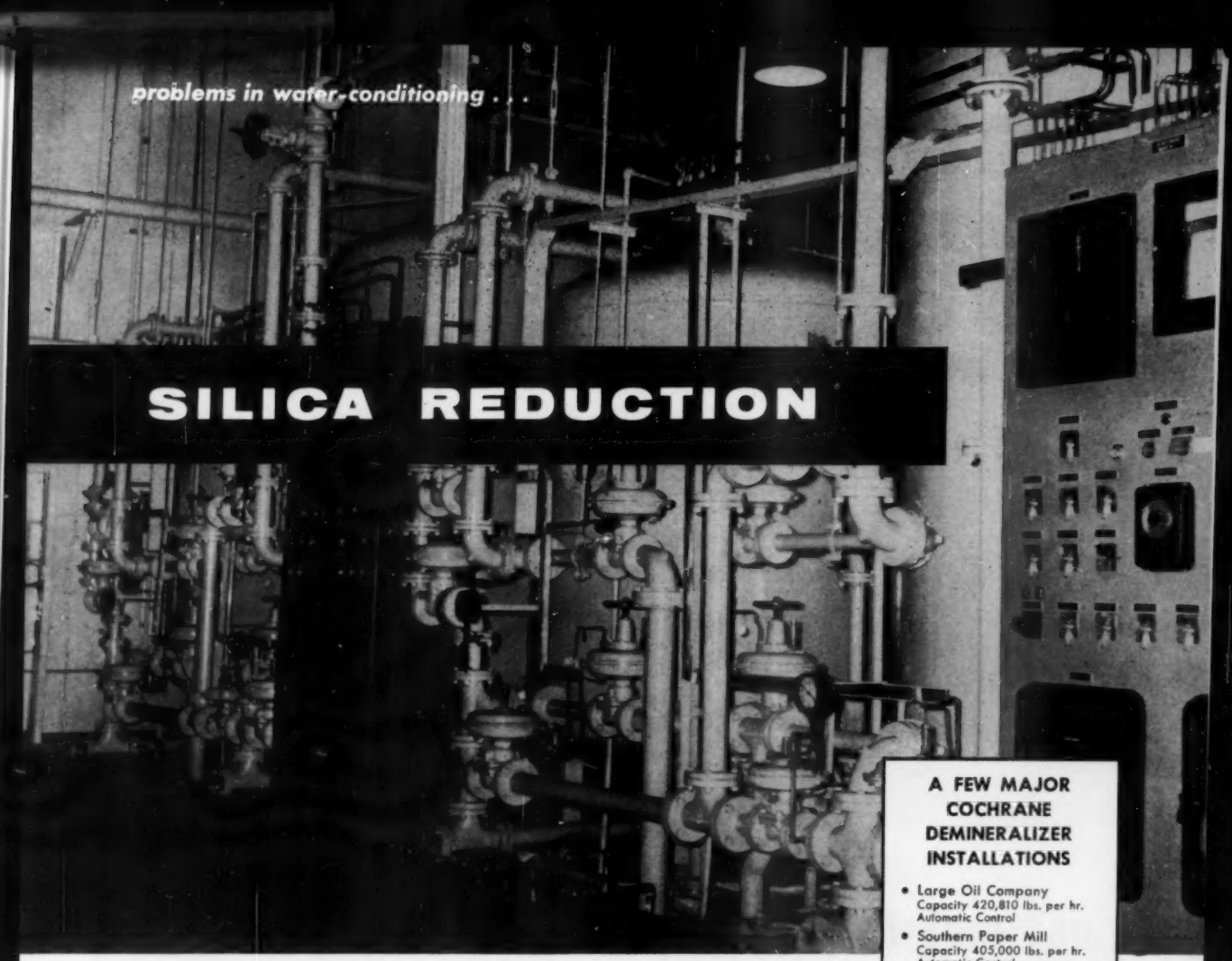
the spindle of the dividing head (C) and its outer end is supported by an L-shaped attachment (D) which can be made up to suit. Alternatively, the support (D) can be dispensed with and the standard tailstock center of the dividing head used instead, but there is often insufficient space to accommodate it.

Modifications necessary for the shaping machine consist of milling a keyway longitudinally for the full length of the cross traverse screw (E). This does not affect the efficiency of the machine for normal duties. On the screw slides a spiral gear (F) having a key which engages with the keyway in the screw. The gear can slide along the screw with the traversing table and is rotated by it. To drag the gear along with the shaping machine table, a bronze yoke (G) is secured to the vertical side of the table by means of a short piece of angle iron (H). An enlarged plan view of the gear and yoke is given at the foot of Fig. 2.

A second spiral gear (f) meshes with the first one (F) to give a right-angle drive from the traversing screw to the horizontal shaft (I). *Spiral or skew gears as used in this example can be replaced by a pair of mitre bevel gears of equal size;* the speed of shaft (I) is the same as that of the shaper traversing screw. The shaft is supported in a pair of bearings which can be standard bearing blocks secured to the vertical side of the shaping machine table.

At the outer end of the horizontal shaft (I) is a chain sprocket (J) which is connected by roller chain to the second sprocket (K). This driven sprocket is connected to the driving gear (L) which, in turn, meshes with the follower gear (M). Driving gear and follower are mounted on the banjo (N) which is a standard fitting on dividing heads suitable for spiral generating, but it can be of forms different to the example illustrated. The driving gear rotates at the same speed as the feed screw on the machine; the ratio between feed-screw and driving gear is 1:1.

With the arrangement illustrated, it will be found that turning the machine table traversing screw (E) with the hand crank will cause the table to travel in the normal manner and will also cause the main spindle of the dividing head to rotate. The rate of rotation for a given table travel is governed by the sizes of the driving and follower gears on the banjo and by changing these pick-off



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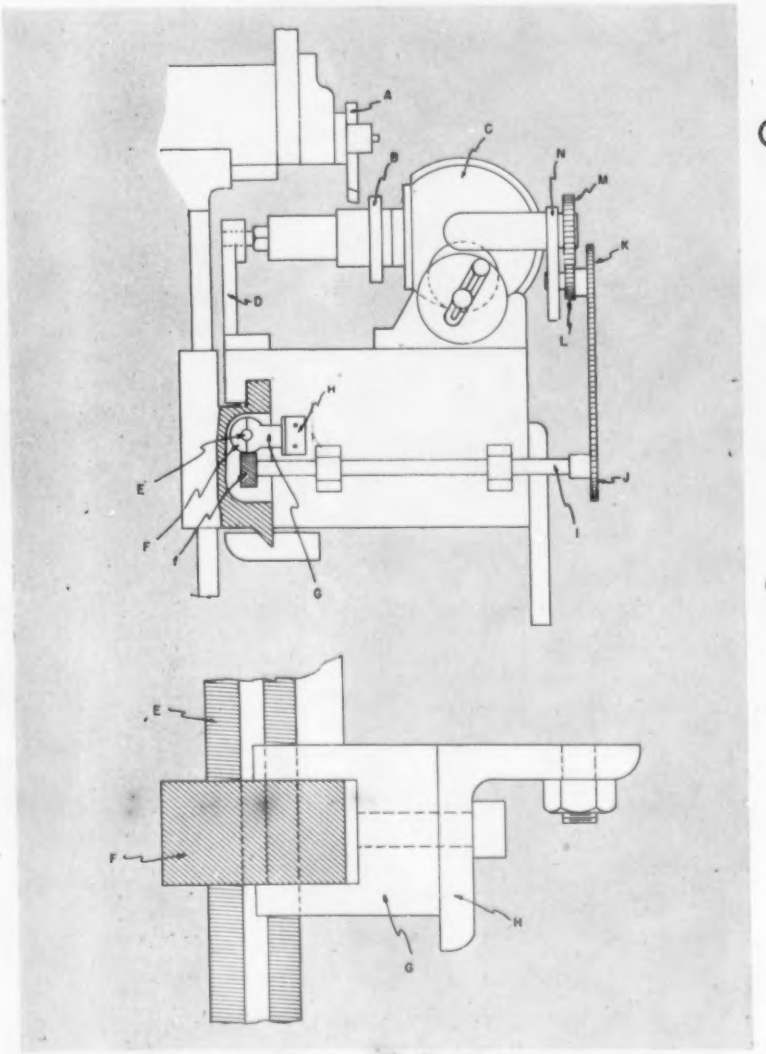


Fig. 2. Set-up of typical shaping machine to cut gear teeth with reciprocating rack-tooth type tool

gears, various circular pitches of teeth can be obtained. The formula for deciding on the size of these gears is as follows:

$$\frac{\text{Teeth in (L)}}{\text{Teeth in (M)}} = \frac{\text{Lead of screw (E)}}{\text{C.P. of tooth (B)}} \times \frac{40}{\text{Teeth in (B)}}$$

In the formula it will be noted that the *lead* of the table feed screw (E) is specified — not the pitch. Also, the circular pitch (C.P.) of the tooth is specified. The circular pitches of standard diametral pitch gear teeth can be obtained from a good handbook (Machinery's Handbook). The factor of 40 in the formula is the number of teeth in the worm wheel of the dividing head. Some old dividing heads have 60 teeth, in which case 60 would be substituted for 40 in the formula. To get the gear ratio of driver and follower to come out to whole quantities, it may be necessary to resort to a compound gear train on the banjo of the dividing head.

Indexing of the gear blank from one tooth space to the next is accomplished by using the normal division plate in the standard manner. When used for indexing, the gear blank will rotate independently of the gears on the banjo.

A shaping tool is the next requirement. Viewed from the front, this tool has the appearance of a basic rack tooth space. The pressure angle of the gear tooth produced is equal to the angles which the sloping sides of the tool make with the shank. Alternatively, the included angle between the sloping sides of the tool is equal to twice the pressure angle. The value of the simple single point shaping tool for gear cutting will be apparent since any desired pressure angle can be obtained on the finished gear tooth by merely grinding the appropriate angle on the tool. Since the sides of the tool are straight, a high degree of precision can be obtained if the tool is ground on a surface grinder.

The tool will have the same proportions of a basic rack tooth space, including clearance at the bottom of the space and it can be measured during grinding by using a standard gear tooth vernier. The tool must be mounted precisely on the tool block of the shaper ram; its theoretical center line being at a right angle to the top surface of the machine table.

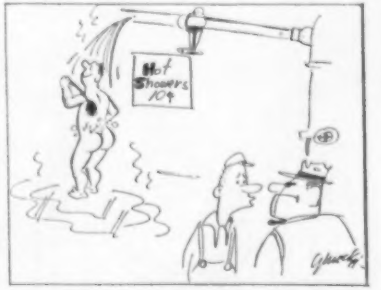
The gear blank should have its outside diameter machined to a fine tolerance since this is of assistance for measuring the teeth when cutting the gear. The gear blank bore should have been machined perfectly concentrically with the outside diameter. When the blank is set up on the mandrel of the dividing head it should be checked with a dial gage for eccentricity. A good gear cannot be produced if the teeth pitch circle is eccentric to the shaft.

Having set up the job and the tool, cutting can commence. The tool center line is positioned over the gear blank axis and, with the shaper ram working, it is fed downward carefully until its flat end makes contact with periphery of the blank. The reading of the shaper tool slide dial is noted and *the tool is then moved downward a distance just short of the full depth of the tooth.*

The shaping machine table is then cranked along until the tool is in the position (a) Fig. 1. The feed to the table can not be engaged and the cycle of generating the tooth will commence as explained in Fig. 1. The table can traverse in either direction but it must, naturally, cause the blank to roll in mesh with the shaping tool.

It is advisable to go all around the gear, roughing out the tooth spaces shallower than finished size and then to make a second circuit to bring them to final size.

Once the initial setting of the dividing head and its driving gear have been arranged on the shaping machine, it is always available for cutting spur gears of a wide range of sizes. The method is rather slow, but it has the merit of producing good quality gears with very limited equipment.



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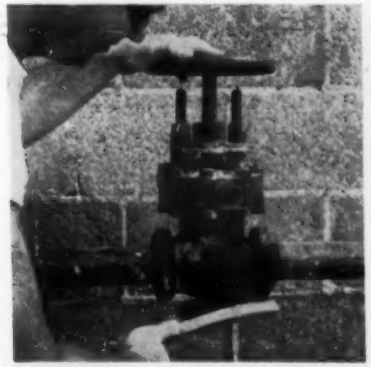

Fig. 1. Surface of valve is wire-brushed to remove excess matter. May be omitted on new work

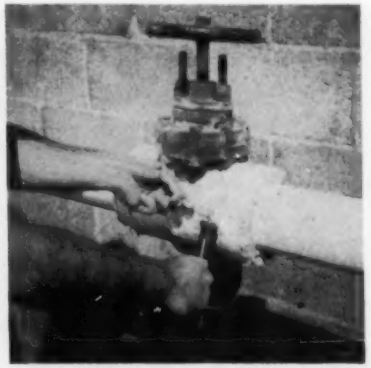

Fig. 2. Pieces of molded pipe insulation are here being cut and wired to fit valve body

Insulate Valves With White Cement

STEP-BY-STEP procedure in Figs. 1–6 shows a valve in a 6-in. high-pressure steam line being covered with both molded pipe insulation and a white insulating finishing cement made by Baldwin-Hill Co. Use of the cement gives a smooth, glazed finish that blends with adjacent pipe insulation, in one-coat application that does not crack while drying. Rain immediately after the initial set does not harm the covering, although the finished insulation should be weatherproofed if permanently exposed to the weather.

Many users trowel the cement on further up the stem of the valve than shown in the photo series. When a valve will not be opened frequently for maintenance, it is good practice to insulate as much of the surface as possible.

The insulating-finishing cement may often be used as the only insulation for valves in the smaller sizes, thus eliminating step shown in Fig. 2.

The cement provides a good paint base (water-based paint can be applied while the cement is wet) but the bright unpainted surface is usually specified.

Thousands of valves on high-temperature piping are today giving off waste heat — paid for in fuel dollars but never used — either because they are poorly insulated or not covered at all.

Fig. 3. White mineral wool insulating-finishing cement sufficient for job is mixed on the spot

Fig. 4. The white cement is troweled smoothly over molded pipe covering and into cracks and voids

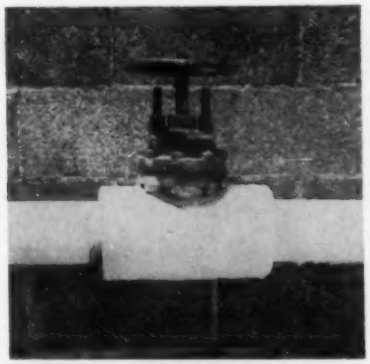

Fig. 5. Gray as applied, the cement on the valve has dried bright white like adjacent pipe covering

Fig. 6. In matching painted pipe covering, cement forms a good surface for oil- or water-based paints

Opening the Pipe Flange

SAFETY precautions for opening a flange are most important. These steps are outlined by D. W. Gibson, director of safety for the Columbia-Southern Chemical Corp.: First, make advance preparations by making sure pressure source is cut off; checking area around flange, for spillage can damage equipment and men; wearing safety equipment; relieving pressure on line; supporting pipe so sections won't fall.

Always use proper tools and equipment. (1) This means non-sparking tools where explosive mixtures are present. (2) Bolts can be burned out one at a time on natural gas line, if line is under pressure and gas is flowing. (3) Do not burn on sulfuric or hydrochloric acid lines when turning bolts; divert flame from pipe. (4) If possible, purge line with CO_2 or other inert gas, fill with water, etc. (5) Bag, rubber or tin sheet shield should be in place depending on contents of the line.

Open flange cautiously. Loosen nuts on the flange farthest away from you, but don't remove. After nuts on opposite side are loose, use ball pein hammer and chisel, drift pin, or wedge to break the flange. Be sure to stand off to one side and if at all possible have your head above eye level of the flange.

Operators demonstrate proper way to open flange

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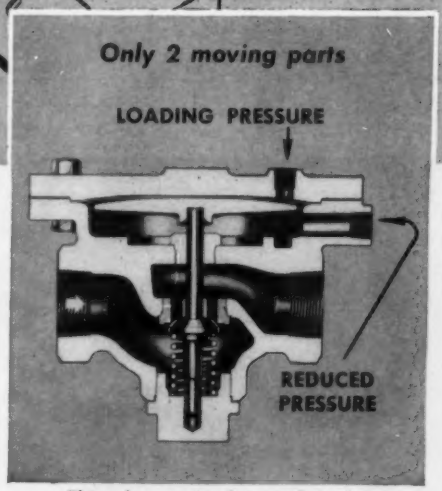

This shows simplicity of Leslie Class G-1 pressure reducing valve.

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This valve is used in steam process and heating lines. And, its uses are unlimited for any steam reductions within body material limits (250 psi, 450°F).

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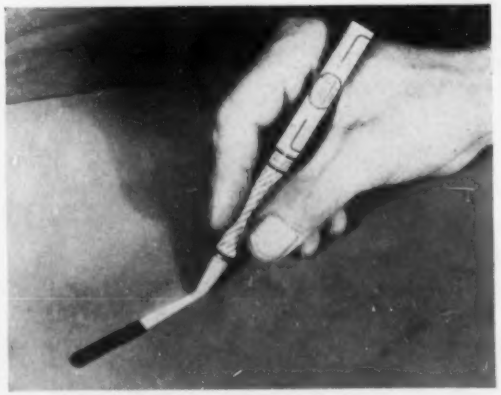

Fig. 1—Left: surface heated to between 425 F. and 475 F. is indicated by the melting 425 Tempil pellet while the 475 pellet remains intact. Fig. 2—Right: A 300 F. Tempilstik being drawn across a warm surface leaves a glistening liquid streak where the surface was at or above 300 F. Lacquers also show temperature

Temperature By Chemical Signal

By G. M. WOLTEN, Tempil Corp.

FOR MEASUREMENT of surface temperatures, there are available today chemical signals that can be deposited directly on the surfaces where temperatures have to be measured. These are obtained commercially as temperature-indicating crayons, liquids, pellets. The crayon and liquid forms are available in some 56 temperature ratings covering the range from 113 F. to 2500 F. in regularly spaced temperature intervals, and the pellets from 113 F. to 2500 F. The accuracy of plus or minus 1 per cent of the stated temperature rating is usually adequate for most industrial applications.

In use, the workpiece is stroked with the proper temperature-indicating crayon from time to time during the heating process. Below the temperature rating of the crayon this will leave a dry mark. When its stated temperature is reached or exceeded, the crayon will leave a liquid smear.

When the heating cycle is of short duration, it is sufficient to make a mark on the workpiece with the proper crayon before the heating begins. When the workpiece reaches the stated temperature, the crayon mark will liquefy, and on subsequent cooling will solidify as a translucent smear, which is readily distinguishable from the original crayon-like mark.

Temperature-indicating lacquer consists of materials very similar in nature to the crayons, suspended in an inert volatile non-flammable liquid. It is especially useful for applications to smooth surfaces such as glass, plastics, or polished metal. Unlike crayons, the lacquer cannot be deposited on a surface which is already hot, but must be applied before heating begins. Applied to the workpiece by dipping, spraying or brushing, it dries quickly to a dull and opaque coating. On heating, the dried lacquer melts as soon as its temperature rating is reached. On cooling, the melted lacquer material solidifies with a characteristic glossy, crystalline, or transparent appearance distinctively different from the original coating.

Temperature-indicating pellets are

Metallizing Engineering Company

Fig. 3. Gas engine cylinder being metallized while rotating in improvised jig set-up. Note mark made by temperature-indicating crayon on right of cylinder, to signal preheat temperature of 350 F.

intended for use in connection with heating of large units, heat-treating operations inside a furnace, and in general where observation must be made at some distance. They must be placed on the workpiece before heating begins. After melting at its stated temperature rating, the liquid residue will survive a long period of heating. Pellets provide an excellent attained temperature signal suitable for subsequent examination.

Intensive research and development work in jet engines, rocket missiles and utilization of nuclear power has spurred the quest for new engineering materials able to withstand the higher working temperature of the atomic age. The adaptation of old techniques and the development of new means for measuring high temperatures accurately present a fruitful area of exploration.

Fig. 4. When its stated temperature is reached or exceeded, the crayon will leave a liquid smear

18 sizes
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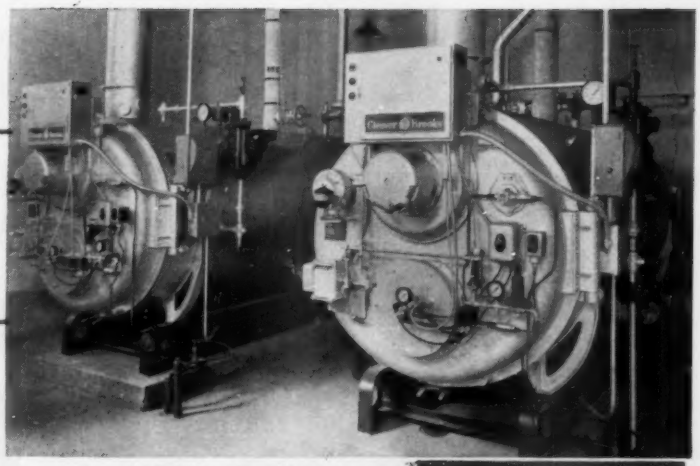
15 to 600 hp



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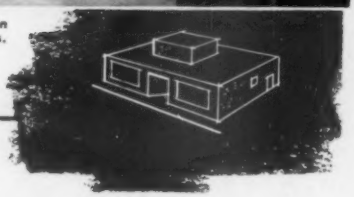

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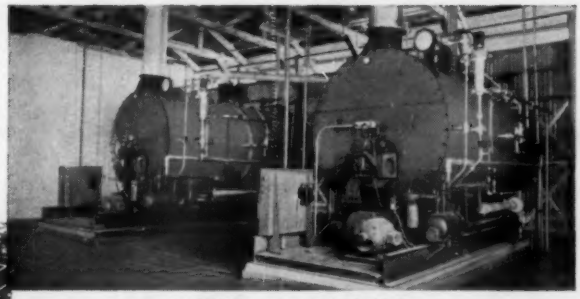

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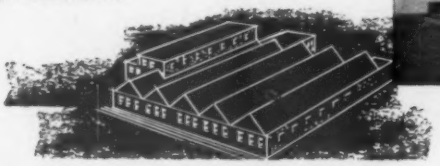

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New Ideas For Better Shopwork

Pulling out dents with vacuum: In maintaining wing-tip tanks on airplanes, Martin has developed a vacuum technique for dealing with dents. A plate, formed to the contour of the tank, is placed over the dent and sealed with a sponge rubber gasket. Connections are made to a two-stage vacuum pump, vacuum is applied and dents pop out. The equipment is portable, and is designed to be useful anywhere

Martin has also developed this tool which drills and removes aluminum cladding from duralumin in one operation, permitting positive electrical connections. Drill is attached to standard wire brush

Air tube has been fixed to exhaust port of air-powered router, oil cup attached to tube. Regulated oil is then fed into air stream which blows on cutters, thus lubricating cutter and clearing chips

Drill stand of die-cast alloy. Polishing raised characters of markings greatly improves readability

Store Twist Drills in Stand Properly Marked

TWIST drills of assorted sizes for use on maintenance work should be stored in a drill stand which has a series of holes of correct drill size and which are marked with characters for drill identification.

The readability of most cast or moulded drill stands can be improved by cleaning them and applying a coat of paint. When the paint is dry the top surface of the raised characters can be rubbed carefully to remove the paint so that the material of the stand shows through clearly.

Plastic drill stands are usually moulded in dark-colored material. To improve their readability, paint with aluminum paint and scrape this off the raised characters so that they are darker than the paint and show clearly.

Check Pulleys For Wear Before Replacing V-Belts

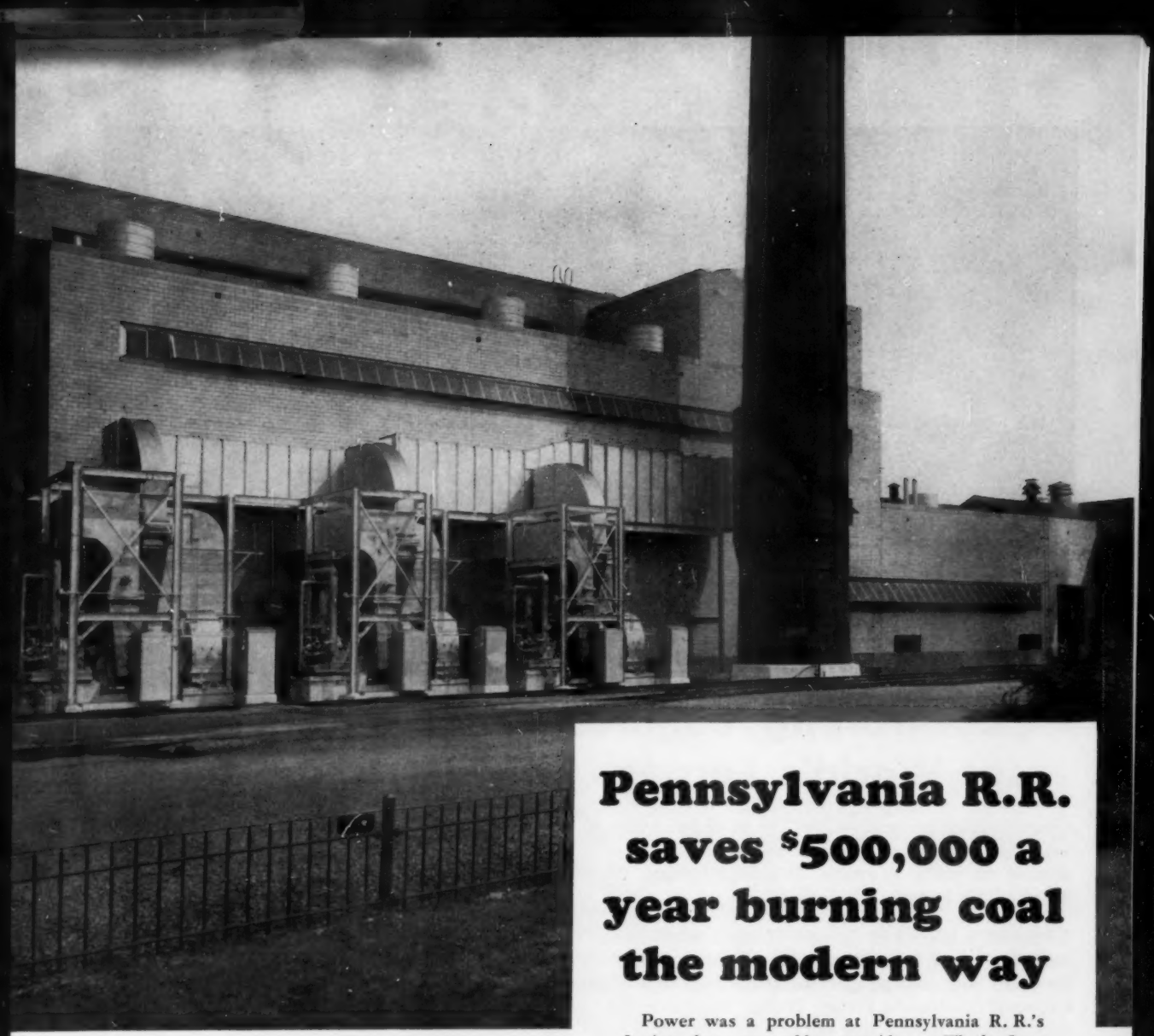
WHEN multiple V-belts are replaced because of wear, belt engineers of the Thermoid Co. advise that several points should be observed. If the original belts have served their expected life, the sheaves or pulleys will probably be from one-half to fully worn out, also. Best practice is to replace pulleys when the belts are replaced. In any case, the pulleys should be examined for roughness in the grooves which will cause excessive wear.

To check for uneven groove wear, move the matched belts from groove to groove and test the difference in play. If uneven tension is observed, the pulleys should be replaced.

Replacement belts should be of the same type and construction as the originals.

Auxiliary hook for trouble light can be soldered on, gives down-shining position to light

Portable holding unit for electrical assemblies, worked out by Martin. Wire assembly is plugged into tool having a T-pin handle. Tool is inserted into wooden receptacle rotated to suit worker



Pennsylvania R.R. saves $500,000 a year burning coal the modern way

Power was a problem at Pennsylvania R. R.'s Juniata shops, part of its great Altoona Works. Low steam pressure was creating costly production delays; electric power failures meant additional delays; obsolete fueling methods resulted in troublesome flyash emission and other problems.

So Pennsy engineers consulted with Gibbs & Hill, Inc.—designers and constructors for the project—and modernized the power plant. Today three 60,000-lb.-per-hr. 600 psi coal-fired boilers supply steam to the shop area at 150 psi after it has driven two 1,500-kw turbine-generators. Between an adequate steam supply and reliable by-product electrical services, production delays have been eliminated. Air pollution is a thing of the past. Modernization of fuel handling has cut manpower costs. And today efficient operation plus lower fuel costs save Pennsylvania Railroad a half million dollars a year!

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

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facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

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Controlling Combustion Electronically at World's Largest Cyclone-Fired Plant

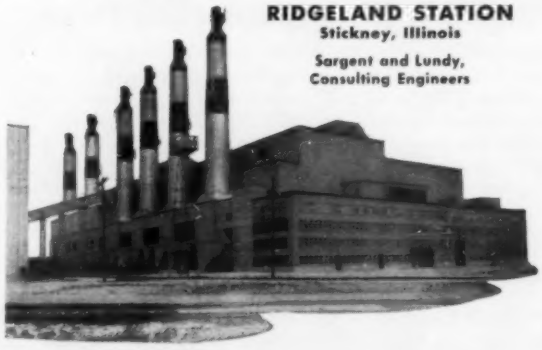
Commonwealth Edison's 640,000 KW Ridgeland Station near Chicago is the largest completely cylone-fired power plant in the world. A total of 28 cyclone furnaces fire the plant's six boilers.

To maintain maximum firing efficiency, combustion conditions at each cyclone are individually controlled and integrated with over-all plant operation by a Republic Electronic Combustion Control System. The system provides separate controls for primary air, secondary air, fuel feed and fuel-air ratio at each of the 28 cyclone furnaces in addition to controlling forced and induced draft fans and feedwater pumps on each boiler. All told, there are more than 130 individual controls which are automatically coordinated for continuous proper combustion.

Republic Electronic Controls handle all of these functions without introducing transmission lags, complicated pneumatic-mechanical linkages and inaccuracies due to mechanical inertia into the control system. Integration of control information is greatly simplified by use of electronic circuits. Expensive panel piping is eliminated and control panels are easier to operate. Because transmission of control impulses is electrical, all parts of the control system can respond simultaneously for smooth, coordinated operation of the boilers.

Ridgeland is but one of many modern cyclone-fired power plants that are equipped with Republic Combustion Controls. In fact, more cyclones are controlled by Republic than by any other make of controls.

Republic makes a complete line of combustion controls for all types and sizes of boilers, all methods of fuel firing, all load conditions and all arrangements of draft. Write us when your problem is combustion controls.



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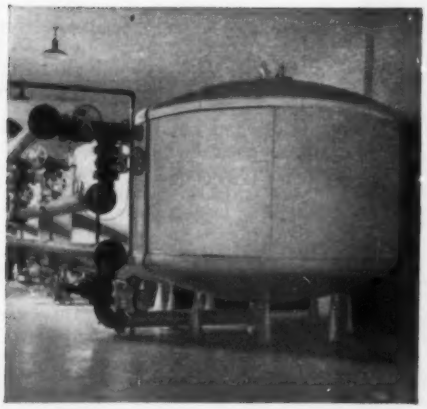
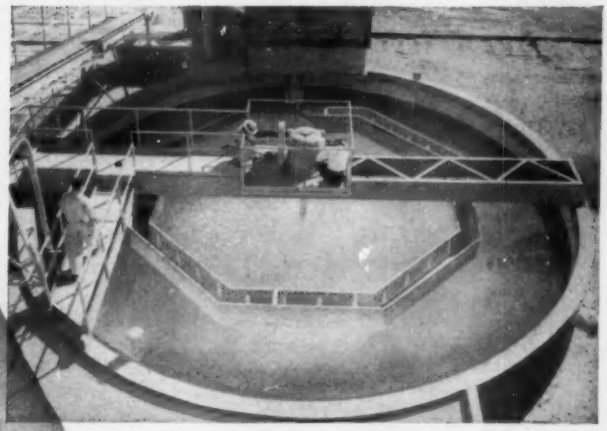


Why General Filter?

There are many reasons why municipalities and industries have installed General Filter water treating plants:



INSTALLATION SUPERVISION . . . General Filter "job-engineers" each installation to the consulting engineer's specification . . . supervises the installation and trains the personnel who will work with the equipment.

OPERATIONAL DEPENDABILITY . . . for twenty years General Filter has concentrated all of its efforts toward "better water treatment". Their efforts have produced water treating plants and equipment that are *completely* dependable.

ENGINEERING KNOW-HOW . . . General Filter's design and construction engineers are familiar with the problems involved in water treatment.

GREATER ECONOMY . . . the only real test of economy is a long term test. General Filter plants stand up over the years providing "better water" with minimum maintenance, longer trouble-free, smoother operation.

Find out why you should specify General Filter . . . Write today for detailed information regarding your water treatment problems.

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". . . *better water*"

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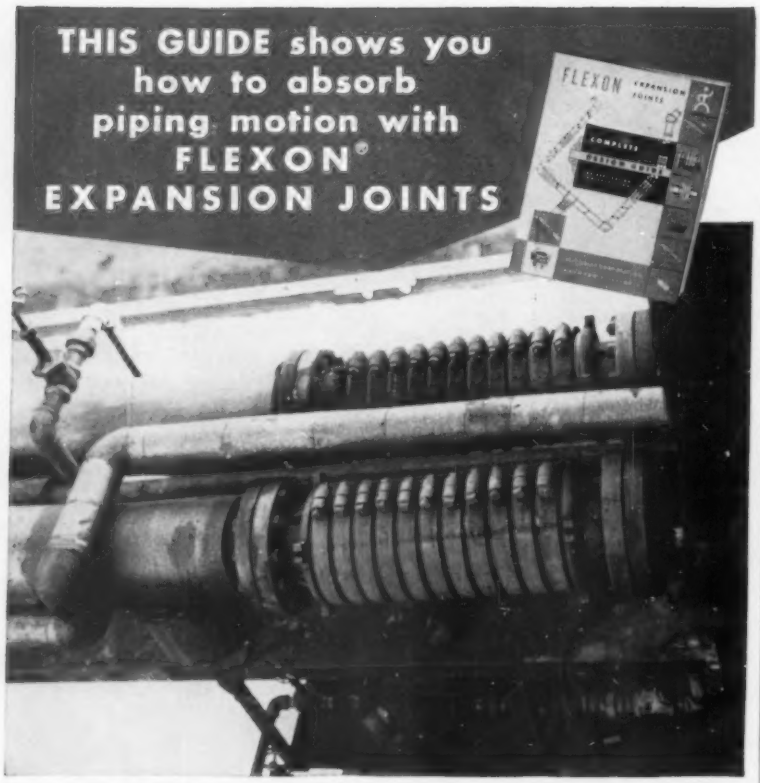

FLEXON® EXPANSION JOINTS

FREE FLEXING TYPE — *Available in sizes from 3" through 48", I.D. in copper or stainless steel. Suitable for pressures from vacuum to 50 psi and temperatures from sub-zero to 850° F.*

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SPECIAL TYPES — *A variety of assemblies are available for special requirements including special very high pressure units for pressures to 5500 psi. For recommendations send an outline of your requirements.*

Here is the authoritative handbook on piping design and layout. Gathered together in this one easy-to-use booklet is a wealth of comprehensive, up-to-date information on modern methods of absorbing pipe motions. Included are thorough discussions of types of motion, design considerations and physical characteristics of expansion joints, anchoring and guiding, typical piping layouts, thermal expansion tables, safety factors and many other important elements vital in piping layout.

Complete specifications are given on all types of Flexon Expansion Joints. These units contain no packing, therefore require no maintenance. Wherever motion or misalignment is present in pipelines you can install Flexon Expansion Joints and forget them.

Much of this data is available only in the Flexon Expansion Joint Design Guide. Copies are available without charge. Write for yours today.

EJ-24

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EXPANSION JOINT DIVISION

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Manufacturers of flexible metal hose and conduit, expansion joints, metallic bellows and assemblies of these components.

In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario

FLEXON® QUALITY

proved in service and backed by over 54 years manufacturing experience

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18th Power Conference

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ground structures of electric power plants is an entirely feasible corrosion control measure, according to R. M. Wainright of the Good-All Electric Mfg. Co. and D. P. Price of the Montana-Dakota Utilities Co.

They explained that such control can be installed for existing plants when bi-metallic and normal soil corrosion becomes a problem, provided that the underground metal structures can be made electrically continuous. The electrical bonding required can usually be carried out successfully, except perhaps on cast-iron water pipes where the joints are non-conducting.

For new plants, a corrosion control system should be incorporated into the original design. For an average-sized plant, this would cost between $2,000 and $5,000, Wainright and Price said.

Underground Hydro

Adolph J. Ackerman, consulting engineer, described recent underground hydroelectric power installations in Europe and South America. A basic prerequisite for this type of project is a favorable geological structure, but the principal question is, "What is the cheapest and best way to develop the available water?"

Ackerman pointed out that the initial cost of an underground development is usually higher than that of any steam plant of similar size. But when it is possible to develop the entire potential of such a project and to absorb such a large block of power in a utility system, then this type of station becomes economically attractive.

New Type Relays

One of the most fascinating papers of the whole conference dealt with the phenomenon of superconductivity — the behaviour of materials at extremely low temperatures, when their resistance drops to zero. The paper, entitled The Cryotron — A Superconductive Computer Component, was given by Dudley A. Buck, of M.I.T.

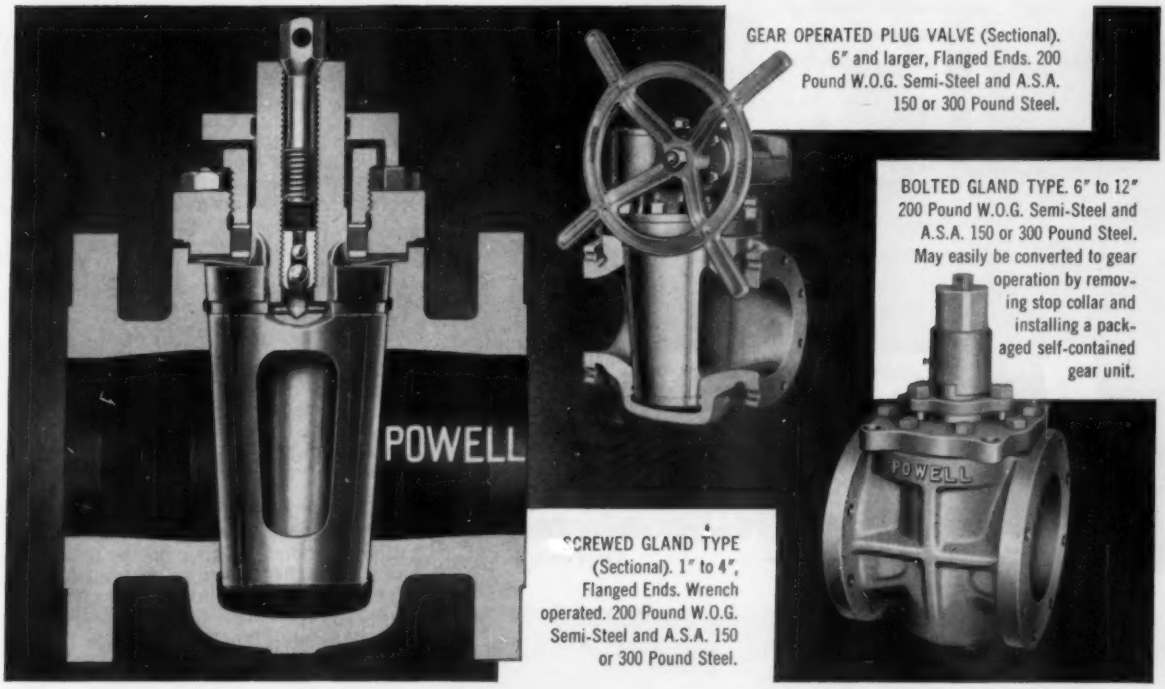
One of the amazing results of the use of cryotrons is as small relays in a computer, with output equivalent to one using 75,000 vacuum tubes; the computer occupies only 1 cu ft! Such a computer would have to operate in a liquid helium bath to produce the low temperature; but present development in helium liquifiers have made liquid helium inexpensive and relatively easy to produce. Apart from the obvious applications for missiles and aircraft, this startling reduction in size, obtained by making use of superconductivity, gives an idea of the many possible applications for such devices as the cryotron.

The cryotron in its simplest form is a straight piece of wire about 1 in.

POWELL

Lubricated Plug

VALVES



GEAR OPERATED PLUG VALVE (Sectional). 6" and larger, Flanged Ends. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

BOLTED GLAND TYPE. 6" to 12" 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel. May easily be converted to gear operation by removing stop collar and installing a packaged self-contained gear unit.

SCREWED GLAND TYPE (Sectional). 1" to 4", Flanged Ends. Wrench operated. 200 Pound W.O.G. Semi-Steel and A.S.A. 150 or 300 Pound Steel.

Powell Lubricated Plug Valves maintain our 110-year tradition of quality and precision. Only the finest available materials are used. And painstaking quality control is rigidly enforced through each and every step of manufacture.

Features include quick and positive operation—just a quarter-turn to open or close. Lubricant grooves surrounding each port provide a positive seal when the valve is closed. In an open position, seating surfaces are not exposed.

Valve users who want one source of supply for lubricated plug as well as all types of bronze, iron, steel and corrosion-resistant valves will want full details on Powell Lubricated Plug Valves.

Available in Steel and Semi-Steel through distributors in principal cities. If none is located near you—or if you need help on valve problems—write direct to

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Tiny currents guard boiler safety

You can operate alarms, fuel cut-out, start and stop pumps safely and accurately with

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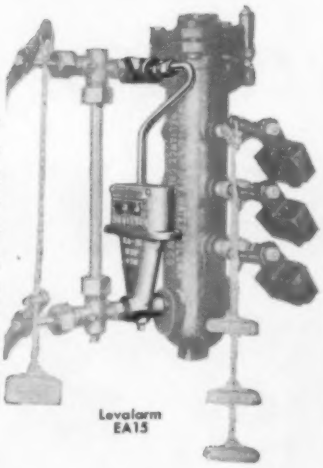
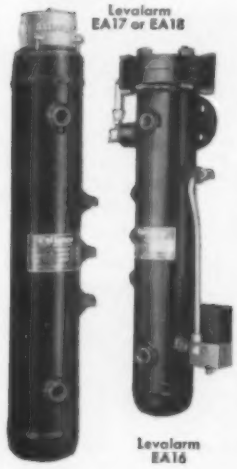
Now you can protect any boiler, from lowest pressures to 2500 psi, with a completely electrical fast-acting alarm system and other controls. Actuated by a tiny current — 25 milliamperes or less — relays pick up signals through the opening or closing of isolated electrode circuits installed on or in the boiler water column. Levalarms are unaffected by pressure, temperature or water conditions.



Levalarm EA15



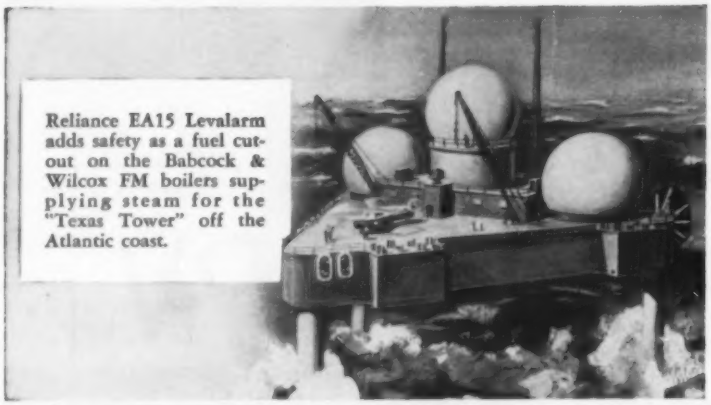
Levalarm EA17 or EA18

Levalarm EA16

Low alarm or high alarm or both, fuel cut-out, and starting and stopping of pumps thus are affected with the speed of electricity *within a small fraction of an inch* change of the boiler water level at predetermined safety points.

The simplest of four Levalarm models, shown above, is a fuel cut-out on a water column. Other variations are for higher pressures and wider variation of control combinations. For the full story about these new Levalarms, write for Bulletin D2.

The Reliance Gauge Column Company
5902 Carnegie Ave. Cleveland 3, Ohio



Reliance EA15 Levalarm adds safety as a fuel cut-out on the Babcock & Wilcox FM boilers supplying steam for the "Texas Tower" off the Atlantic coast.

The name that introduced safety water columns....in 1884

Reliance®

BOILER SAFETY DEVICES

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18th Power Conference

continued from page 102

long with a small single layer control winding over it. Current in the control winding creates a magnetic field, which causes the central wire to change from its superconducting state to its normal state, thus producing the required relay action. The device has current gain; i.e., a small current can control a larger current and it has power gain, so the cryotrons can be connected in logical networks as active elements. The device is also small, light, easily built, and dissipates very little power. An idea of its size is given by the fact that in the 1 cu ft space mentioned above, there are 250,000 elements.

Among the many interesting items of information given in the paper, the general behaviour of materials deserves special mention. Ordinary wire insulation, enamel, silk, glass, Formex, Formvar, etc, show no sign of failure after repeated immersion in liquid helium. Metals in general are much stronger at extreme low temperatures. Some are relatively good thermal insulators (stainless steel and cupro-nickel) and may be used for mechanical support, and, as the author remarked in his paper, there is no basis for the common impression that everything falls apart just below −85 C.

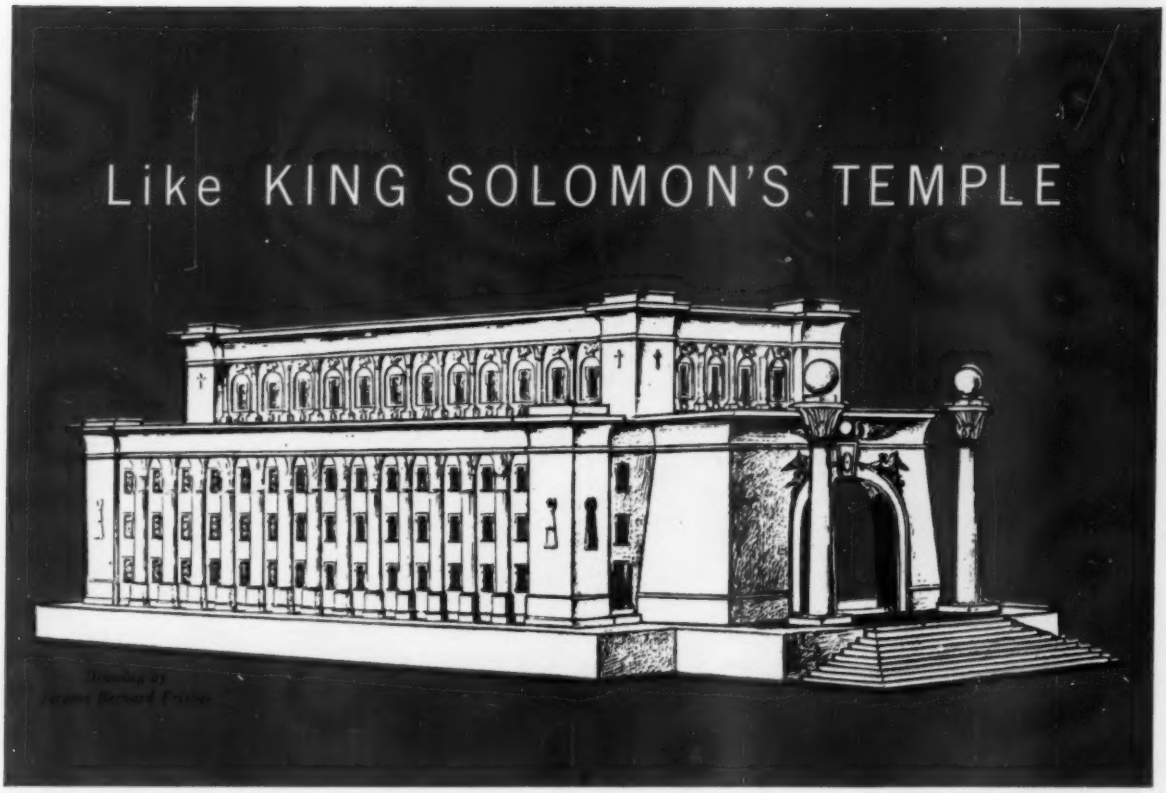
Operation of the cryotron is at present somewhat faster than an electromechanical relay, but far slower than vacuum tubes and transistors. However, a program is underway to increase the speed.

Distribution Voltages

Two very interesting papers, giving different points of view on the question of higher distribution voltages for residential consumers, were given by engineers from General Electric Co. and Westinghouse Electric Corp.

D. K. Blake, of GE, in his paper entitled Economics of 240/480 V as Residential Utilization Voltage, suggested that the amount that would be saved by the consumer (he showed how the maximum would be 5 per cent for a 240/480-V system) was not enough to win the consumer's approval in view of the experts' disagreement on shock annoyance and hazard.

Robert F. Lawrence, of Westinghouse, on the other hand, in his paper entitled Higher Secondary Voltage — a Solution to Future Distribution came up with an estimate of considerably larger savings and questioned the validity of objections on grounds of safety. He pointed out that domestic voltages of 220–240 v to ground are in extensive use throughout the world, and he also mentioned that in our own country television sets and precipitator air cleaning units contain equipment having terminal voltages of the order of 12,000–15,000 v, but are considered safe be-



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for Standards of High Quality

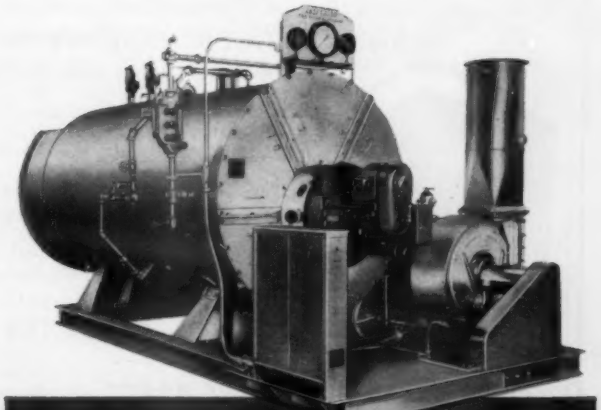
The oldest known definitive specifications* for quality construction are those for King Solomon's Temple. They are positive, precise, completely detailed.

For the Preferred Unit Steam Generator, the specifications for highest quality are just as definitive. Here, too, no detail has been spared in its design, engineering and assembly to make it outstanding in every respect. That is why, though a Preferred Unit may cost a little more than other "package" boilers, it is worth much more to those concerned with maximum heating efficiency, lowest fuel cost, fully automatic operation and minimum maintenance.

When you install a Preferred Unit you acquire an investment in unmatched, long term, dependable operation. There is no boiler that gives you comparable value.

Bulletin 2000 gives complete details.

*To be found in the Bible, Second Book of Chronicles, 3rd and 4th chapters.



PREFERRED UNIT STEAM GENERATORS

PREFERRED UTILITIES MANUFACTURING CORP. Dept. PE—1860 Broadway, New York 23, N. Y.

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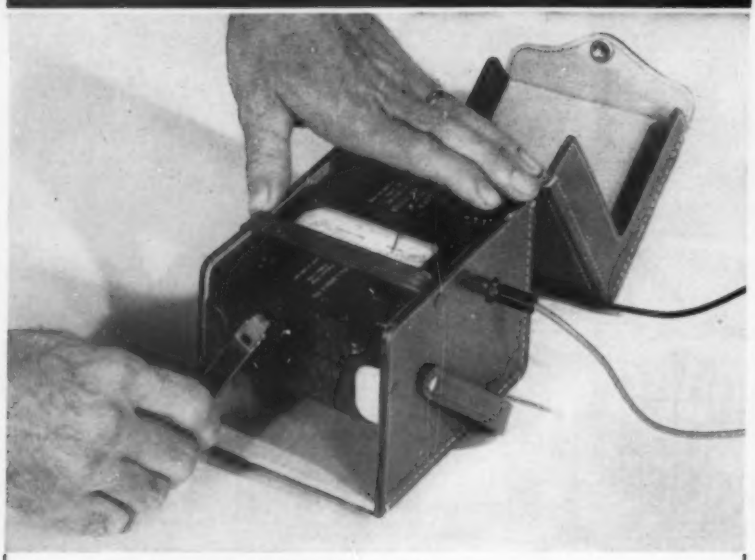
BIDDLE *Instrument News*



A MIDGET MEGGER® MAKES A BIG DIFFERENCE IN MAINTENANCE PROBLEMS

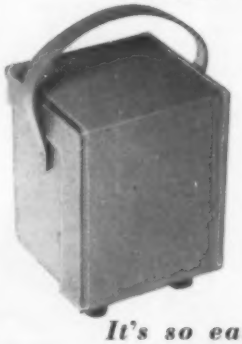
The operating span of electrical equipment can be shortened considerably by accumulations of *dirt* and *moisture*. If no attempt, or only infrequent attempts are made to check equipment, trouble is sure to result—and at the most inopportune time.

Only by periodic insulation resistance measurements can you be sure of the condition of electrical insulation in your machines. Test with a dependable Megger Insulation Tester and keep records of each piece of equipment.

Take advantage of Summer vacation shutdowns to locate all the weak spots in your important electrical equipment.

For Convenience and Protection . . .

MIDGET "MEGGER" INSULATION TESTER



Operated without Removing from the Case

The Midget Megger Insulation Resistance Tester is a compact and rugged little set for detecting and diagnosing faulty insulation before serious and costly damage occurs. It is shown here in a "camera-type" leather case which permits operation without removal from case. The test leads store in the bottom of the case. For rugged shop and field use this sturdy "package" is hard to beat. Ranges up to 50 megohms, 500 volts d-c. Low cost.

Write for BULLETIN 21-85-PE

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- SPEED MEASURING INSTRUMENTS
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18th Power Conference

continued from page 104

cause they are inaccessible to children and are not subjected to tinkering by unskilled persons.

Both papers quoted figures emphasizing the phenomenal projected increase in the use of electric power by domestic consumers. The 1954 national average was an annual consumption of 2500 kwh per home. The estimated annual consumption per home in 30 years may be as much as 12,000 kwh, and with a heat pump for winter heating and summer cooling might come to as much as 25,000 kwh per home.

Both authors agreed that the subject needs very intensive study right now, because if changes are going to be made they need to be on a small scale, and they will become increasingly difficult as loading per consumer rises.

Atomic Insurance

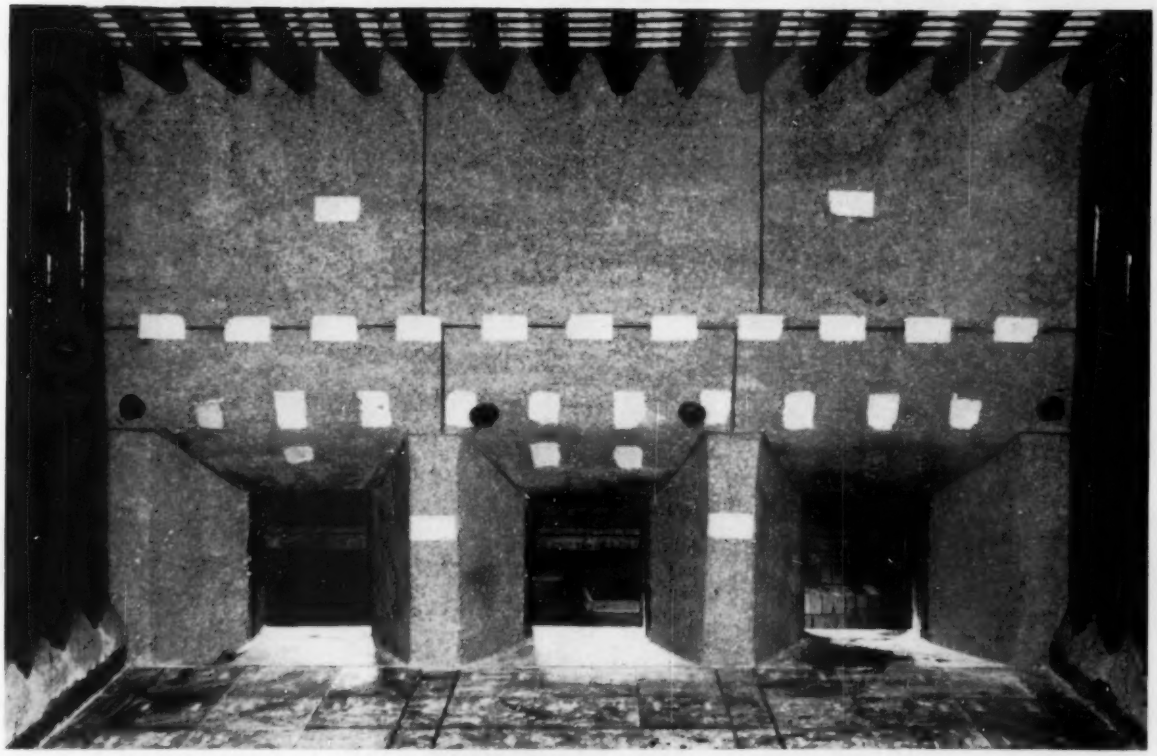
Problems of the insurance companies asked to insure nuclear power plants were well explained by Charles H. Haugh of the Travelers Insurance Co.

The capital stock companies, which write property insurance, have taken steps to create a syndicate to cover power reactors. This property insurance syndicate expects to have a capacity of at least $50,000,000 for each separate reactor installation. This is approximately equal to the maximum cost of any of the five power reactors currently under consideration.

The capital stock companies which write liability insurance are organizing a syndicate which it is expected will have sufficient capacity to afford as much as $50,000,000 of liability insurance on each reactor location for personal insurance.

Now the problem is that there are at the moment only five reactors under consideration. Suppose each one is insured for $100,000,000. This means the insurance companies have a total amount at risk of $500,000,000. And the premiums for this exposure are to be spread over five risks! Obviously, with only five risks, it is impossible to accumulate a sufficient sum to meet a maximum loss within any reasonable period of time. Eventually reactors will be in use generally throughout the country, but in the meantime, as Mr. Haugh pointed out, the insurance companies, like the power utilities, are pioneering in the field of nuclear reactor development.

Profitable trends in the use of refractories



Boiler furnace efficiency UP, costs down with use of Laclede Plastic Refractories

Here's a good example why the trend to Laclede Plastic refractories is a profitable one: A bottled-up furnace was about to be shut down because of low efficiency and high refractory maintenance. Laclede-Christy engineers checked the problem, then recommended that the furnace walls and a newly designed arch be installed, using Laclede Super Plastic Refractory.

The results were spectacular. The furnace went into continuous operation, at 150% to 175% of rating. Maintenance costs dropped to practically zero. A new boiler installation was postponed, saving nearly $250,000.

If it happens to others, why not to you? Check Laclede-Christy for specific recommendations.

Laclede-Christy offers 3 types of Plastic Refractories

Each Laclede product is designed for specific purposes — *Super Plastic* for temperatures over 2600° F, *Furnaseal* for temperatures under 2600° F, *Super Set Plastic* where air dried bond is required.

All Laclede Plastic Refractories form a jointless, monolithic construction that resists the destructive actions which shorten the service life of refractories. Laclede Plastics are always dependable — and promptly available.

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OBITUARIES

Edwin B. Ricketts

EDWIN B. RICKETTS, 72, former mechanical engineer of Consolidated Edison Company of New York, died at his home in Flushing, N. Y. after a brief illness. He had retired from Con Edison in 1948 after 40 years of service, later becoming associated with Wearn, Vreeland, Carlsen and Sweatt, Inc., New York, N. Y., as consulting engineer.

Mr. Ricketts was born in Mississippi and earned a B. S. degree at Millsaps College. Interested in the economic development of the south, he left New York Edison on two occasions, first accepting employment with southern sugar companies, and later as a steel salesman, he made his headquarters in Birmingham.

His early association with New York Edison began at Waterside, the company's largest station at that time. Starting in the field of boiler testing, his talents enabled him to assume the positions of chemist and engineer of tests. In the 1920's his practical knowledge of mechanical engineering, greatly influenced the design of Hell Gate and East River stations. In the 1930's he became assistant mechanical engineer, following the integration of the electric companies; and in 1939, mechanical engineer for Con Edison.

E. B. Ricketts

Mr. Ricketts enjoyed a national reputation as an outstanding engineer. He held important committee posts in the Edison Electric Institute, American Standards Association, Association of Edison Illuminating Companies, American Society of Electrical Engineers, American Society for Testing Materials, and the National Fire Prevention Association. During World War I, he made substantial contributions to the design of boiler plants and steam and electric transmission lines at the Nitro, W. Va. munition plant.

Blake R. Van Leer

COL. BLAKE R. VAN LEER, president of the Georgia Institute of Technology, died recently at the age of 62. The fifth president of Georgia Tech since its establishment in 1885, and the first engineer to hold the position, Colonel Van Leer was appointed to the office by the Board of Regents of the University System of Georgia in 1944.

Colonel Van Leer

Born in Mangum, Tex. (now in Oklahoma), Colonel Van Leer as an engineer brought credit to Georgia Tech by being asked by the State of Georgia and the Federal Department of Defense to do important engineering work. His counsel was asked frequently by the several national engineering societies.

He was tireless in his efforts to aid

For Lower-Cost Installation and Longer Service Life

EASIER TO INSTALL, on new construction or as replacements for other types. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted . . . no gaskets required. "Flang-Lok" Joint are especially easy to install.

RESPONSIVE TO MINIMUM PRESSURE. Only slightest pressure is required to create movement in the rubber joint, in any direction. Result —stress on metal pipe or other member is reduced to absolute minimum

HIGHER WORKING PRESSURES. Goodall Rubber Expansion Joints operate efficiently at working pressures to 125 lbs. P.S.I., depending on size.

LONGER SERVICE LIFE. No embrittlement . . . continuous movement (flexing) actually keeps the rubber joint "alive." No corrosion. No electrolysis. Highest resistance to abrasion.

Sizes ⅜" to 96", I.D., for Pressure and/or Vacuum

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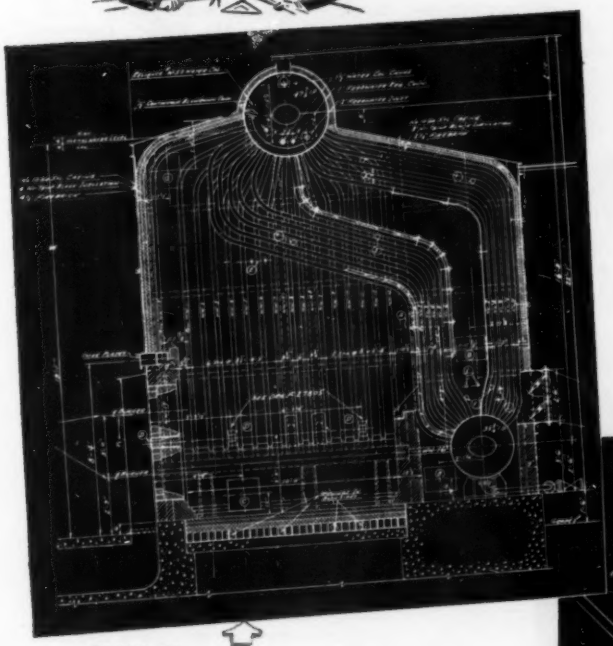
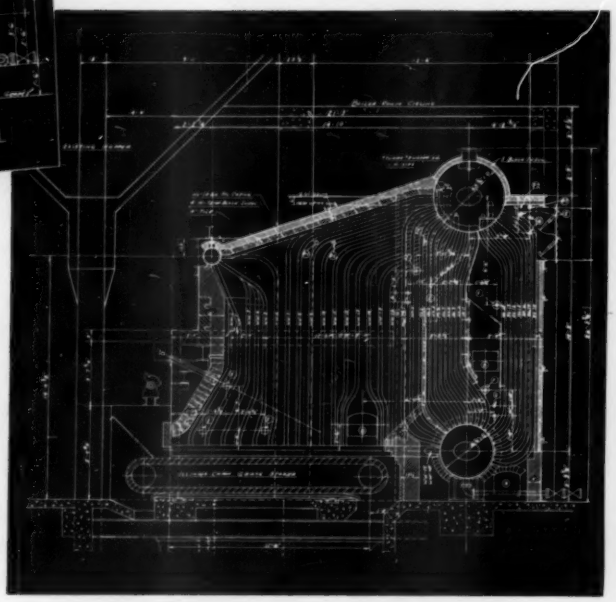
STEAM GENERATORS

by Vogt



CLASS VF
A 22,000 pounds steam per hour unit installed at Indiana Farm Bureau Refinery, Mt. Vernon, Ind.



CLASS VS
The Seelbach Hotel, Louisville, Ky. is served by this 30,000 pounds steam per hour boiler.

A wide variety of industrial plants and other users of steam for power, processing, or heating have found these efficient Vogt Two-Drum Type Boilers to be the answer to their diverse steam generating requirements.

Class VF units provide maximum capacity in limited floor space and head room, while Class VS is best adapted to installations not having such restrictions. Each has a large furnace volume and a high ratio of radiant heating surface. The furnace design assures proper combustion of fuels fired in suspension or with various type of stokers.

A bulletin with general information and showing typical installations is available on request.

ADDRESS DEPT. 24-BPE

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DISTILLERIES • HOTELS

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Obituaries

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the economy of not only Georgia but that of the Southeast. As a member and first chairman of the Georgia Ports Authority in 1945, he helped to bring Savannah back as an important Atlantic port. His other community activities included membership on the U. S. National Commission for UNESCO (1946–49); Board of Visitors of the Air University (1950–53); Board of Advisors, Industrial College of the Armed Forces (1954–); Construction Industry Advisory Council (1955–); and Advisory Committee on Engineers of the U. S. Civil Service Commission (1950–).

From 1928 to 1931 he served in Washington, D. C. as the assistant secretary of the American Engineering Council, which did so much to raise the professional status of the engineer.

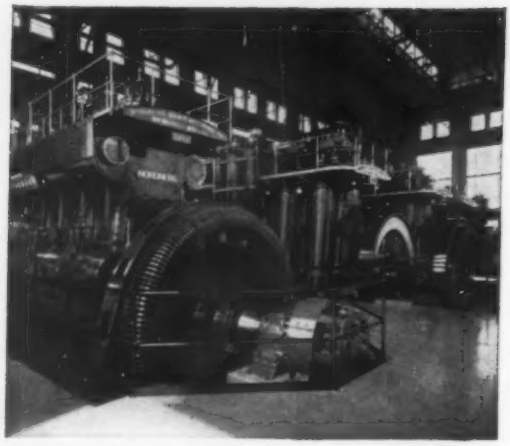
Colonel Van Leer was a great believer in research. Under his administration the Georgia Tech Research Institute was organized and the activities of the Engineering Experiment Station greatly expanded, including construction and operation of an A-C Network Analyzer Laboratory, fluid flow laboratory, Rich Electronic Computer Center, and many others.

He served in World War I as a lieutenant with Co. F, 316 Engineer Corps, U. S. Army and spent 13 months overseas, receiving the Croix de Guerre from the French Government. After serving in the Organized Reserve Corps from 1928 to 1942, he was recalled to active duty in World War II as a major, being promoted eventually to a colonel of the Corps of Engineers, U. S. Army.

As chief of the facilities branch of the Army Specialized Training Division, Washington, D. C., Colonel Van Leer was responsible for the army training programs at colleges and universities throughout the country. In 1950 he was appointed chairman of the Defense Department special committee to select a site for the $11,000,000 U. S. Army Quartermaster Research and Development Laboratory.

WORN Cylinders?

SCORED Cylinders?



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is the answer.

- Reclaim the bores of worn or scored power cylinder liners with wear resistant **PORUS-KROME.**
- Write for detailed information on this economical service for power plants.

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*SparTan Engineering

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. . . Steel Foundation

continued from page 73

200 psi. They burn diesel fuel oil or natural gas. A 2-cylinder Wisconsin engine drives water pump, fuel pump, forced draft and magneto.

High-pressure steam hoses in lengths of 50-ft. connected each generator to the steam hammers on the leads attached to the Caterpillar cranes. A large single-action hammer, for use on the 14-in. beams, develops more than a 12-ton blow, while a large double-action hammer develops 24,450 ft lb. Two smaller hammers, used on the 10-in. beams, develop almost 4½ tons per blow; one operated on steam, the other on compressed air.

Five Caterpillar cranes were in operation on the job during the pile-driving stage. Two rigs, a Lima 802 and a Manitowoc 3500, drove the 14-in. H-beam piles, operating with leads 85-ft. and 84-ft. high. A third crane, a Manitowoc 3000, was for general service. The fourth and fifth rigs, a Lima 1001 and a Manitowoc 2000B, drove the 10-in. and 12-in. beams.

The foundation work is being done by Spencer, White & Prentis; the building will be constructed by Turner Construction Co.; the building was designed by Skidmore, Owings & Merrill.

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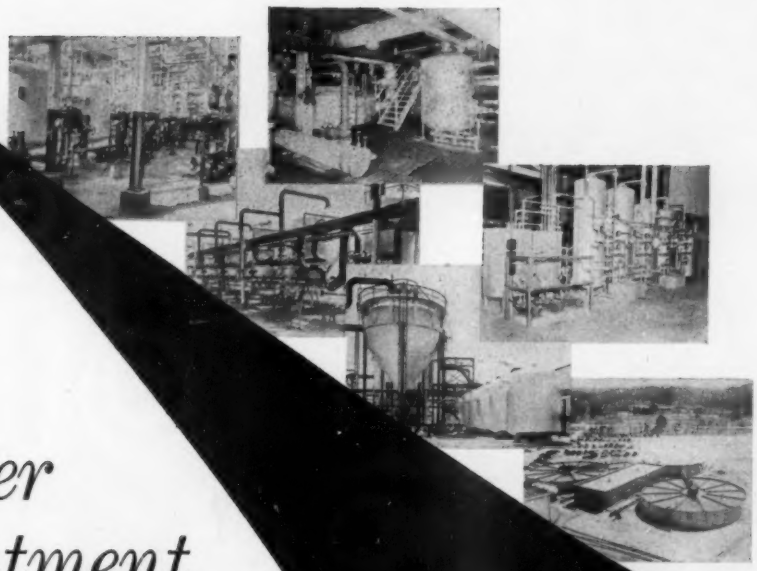

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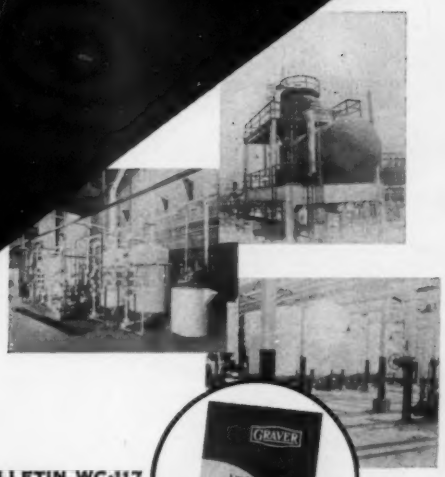

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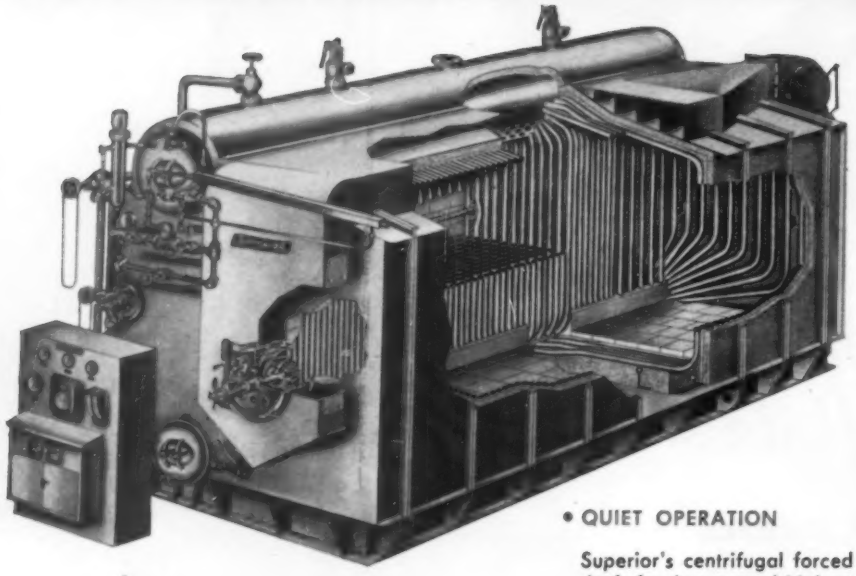

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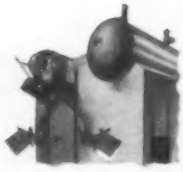

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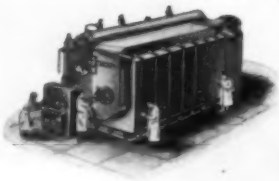

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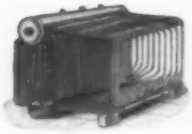

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PUMPS, COMPRESSORS

201 Boiler Feed Pump — A barrel-type boiler feed pump for high pressure, high temperature service and designed to go on the line quickly without preliminary warm-up is the subject of 12-pp Bulletin 1525. De Laval Steam Turbine Co.

202 Controlled Volume Pumps — Bulletin 953, 24-pp, describes and illustrates use of controlled volume pumps in industrial water treating systems. Construction and operation features are described, capacity-pressure ranges and speed and stroke length adjustments are charted. Typical chemical feed and water treating systems are presented through text and diagrams; and an analysis of boiler water treating systems, cooling water treating problems, and systems for waste and sanitary water treatment included. Milton Roy Co.

203 Boiler Feed Pump — Bulletin 08B7899, 16-pp, describes design features and principal advantages of company's barrel type boiler feed pumps. Shows why balanced thrust design gives radial and axial balance for greatest reliability and for smooth operation and longer pump life. Allis-Chalmers Mfg. Co.

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204 Sump Pump Selector — Bulletin 54-3-1420, 20 pp, provides a selection table allowing a power engineer to choose any of the 4000 models of the BJ Sumpmaster pumps, which range from 10 to 2600 GPM with heads from 20 to 300 ft. Includes dimensions. Byron Jackson Co.

205 Horizontal Compressors — Bulletin L-640-B1C. 24 pp, presents single-stage horizontal compressors from 50 to 2000 cfm and from 10 to 150 psi. Gives information on basic specifications, standard equipment, capacity control, cylinder construction, other factors. A diagram of a complete installation is included along with cutaway views of major components and accessories. Worthington Corp.

WATER CONDITIONING

206 Water Softeners — Cutaway drawings in Bulletin MSP-123 illustrate construction of company's water softeners, and indicate simple connections by which a softener is fitted into a water system. Capacities of the various models are given, together with specifications. Hagan Corp.

207 Demineralizers — Valuable information on demineralization is offered

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power engineers in comprehensive 24-pp Bulletin WC-111. Discusses demineralization in general and its advantages and applications. Basic types of demineralizers and their special uses are charted. Resins, piping, valves and accessory equipment are treated in detail. Book also provides flow charts showing demineralization systems for chemical plants and power plants. Graver Water Conditioning Co.

208 Handbook on Demineralizing — Comprehensive 40-pp Bulletin 5800-B compares various methods of water treatment, indicating the comparison between demineralizers and evaporators. It discusses the characteristics of the various types of available cation and anion exchange materials and offers data on operating costs of demineralizing. It tells when to use 2-bed, 3-bed, 4-bed, mixed or monobed demineralizers. It also indicates when decarbonators or vacuum deaerators should be installed. Cochrane Corp.

209 Water Treatment — Bulletin 5000, 24 pp, explains the reasons for boiler water treatment and tells services offered by company in providing formulations for individual plant requirements. Covers pretreatment, internal treatment, treatment application, blow-down adjustment, test control. Dearborn Chemical Co.

210 Water Conditioning Data Book — An excellent reference volume, Data Book 2478A contains 108 pp and presents a compilation of 78 chapters and tables. Subjects covered include hydraulics; impurities in water; chemical conversions; coagulant, acid and alkali dosages; chemicals used in water treatment; water treatment processes; boiler feed make-up requirements; alkalinity relationships; specific gravities; chemical reactions. Available to qualified power engineers, please state your job title when requesting this. The Permutit Co.

211 pH and Chlorine Control — The 12th edition of company's handbook "Modern pH and Chlorine Control," 100-pp, incorporating theory and practice of colorimetric analysis, serves as a reference for quantitative determination of pH, chlorine, phosphate, nitrite, sulfate, hardness and other tests. Slide comparators and complete test kits are illustrated. In addition to standard pH determinations, methods are outlined for quantitative analyses of phosphate, calcium, magnesium, silica nitrate hardness in feedwater. Available to qualified power engineers. W. A. Taylor Co.

212 Feedwater Treatment — Process Bulletin B1, "Treatment of Boiler Feedwater by Direct, or Internal Method," discusses advantages of direct treatment, as a complete treating program or as a supplement to external systems. Explains why direct treatment is convenient, economical and complete, and points out how it improves steam quality and reduces boiler maintenance costs and downtime. National Aluminate Corp.

LUBRICATION

213 Turbine Lubrication — The special problems of turbine lubrication are discussed in 8-pp Bulletin TU-1. Tells how purifiers keep power units in service; discusses inhibited and uninhibited oils, company's process for reducing sludge formation within lubrication system. Illustrated with diagrams of typical installations. DeLaval Separator Co.

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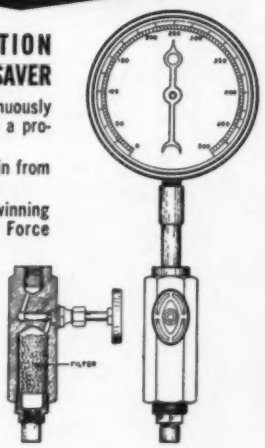

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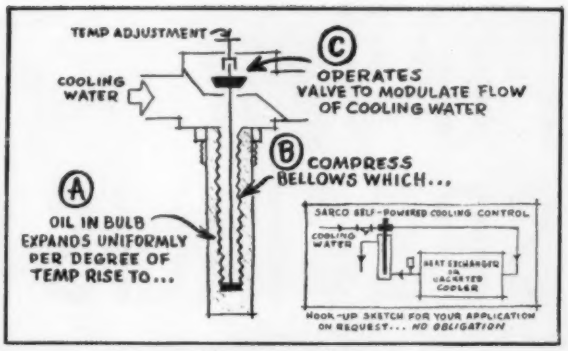
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214 Bearing Lubrication — Vol. XL, No. 10 of this company's Lubrication magazine provides an excellent 12-pp article on industrial bearing lubrication. Illustrated with photos and drawings, text covers such subjects as bearing design; bearing surfaces; bearing overhaul; aspects of lubrication, including factors involved in choice of turbine oils and diesel lubricants, and the deleterious effects of moisture; and the life expectancy of bearing lubricants. The Texas Co.

215 Lithium Soap Greases — This product information bulletin details qualities and specifications of company's multipurpose lithium soap industrial greases. Advantages of multi-purpose grease use — such as prevention of lubricant misapplication, simplified maintenance procedures discussed, together with performance characteristics. Sinclair Refining Co.

216 Versatile Industrial Oil — Described in 20-pp Form AD 4078 is an all-purpose oil offering protection for a wide range of industrial equipment, and available in 15 viscosity grades. Discusses six major characteristics of the oil; explains and pictures its use in hydraulic systems, speed reducers, air compressors, electric motors, hydraulic turbines, bearing systems, etc. A chart shows grades available, their uses and physical properties. Standard Oil Co. (Ind.)

COAL, ASH HANDLING

218 Fly Ash Collection — The successful and economical separation of fly ash from boiler flue gases is discussed in 28-pp Catalog G405. Explains need for collection equipment and gives physical characteristics of fly ash. Describes company's Multiclone equipment as to principle of operation, performance and advantages. Western Precipitation Corp.

219 Tractor Shovel — The engineering, design and production stories of company's HD-11G tractor shovel are pictorially presented in 8-pp Catalog MS-460. Includes specifications and describes various features which mean easier servicing for less time-down and greater operator comfort. Allis-Chalmers Mfg. Co.

220 Spreader Stoker — Sixteen-pp Bulletin 800 describes manufacturer's Type C-C RotoStoker, a relatively small spreader stoker offering continuous cleaning and ash discharge advantages of larger units, without need of a basement for ash-removal. Explains this and other operational advantages of the stoker, which is adapted to modern steam boilers with output capacities of about 5000 to 75,000 lbs of steam per hour. Detroit Stoker Co.

BOILERS, GENERATORS

221 Packaged Boilers — This 16-pp illustrated catalog describes manufacturer's new Type VP package boiler. Following a section of background information is an outline of the principal design features of these boilers, which are shop assembled and provide steam capacities from 4000 to 40,000 lb per hour. Space requirements are shown in a table along with typical specifications. Also described is control system. Combustion Engineering, Inc.

222 Automatic Boilers — Bulletin BE-4 describes operation and advantages

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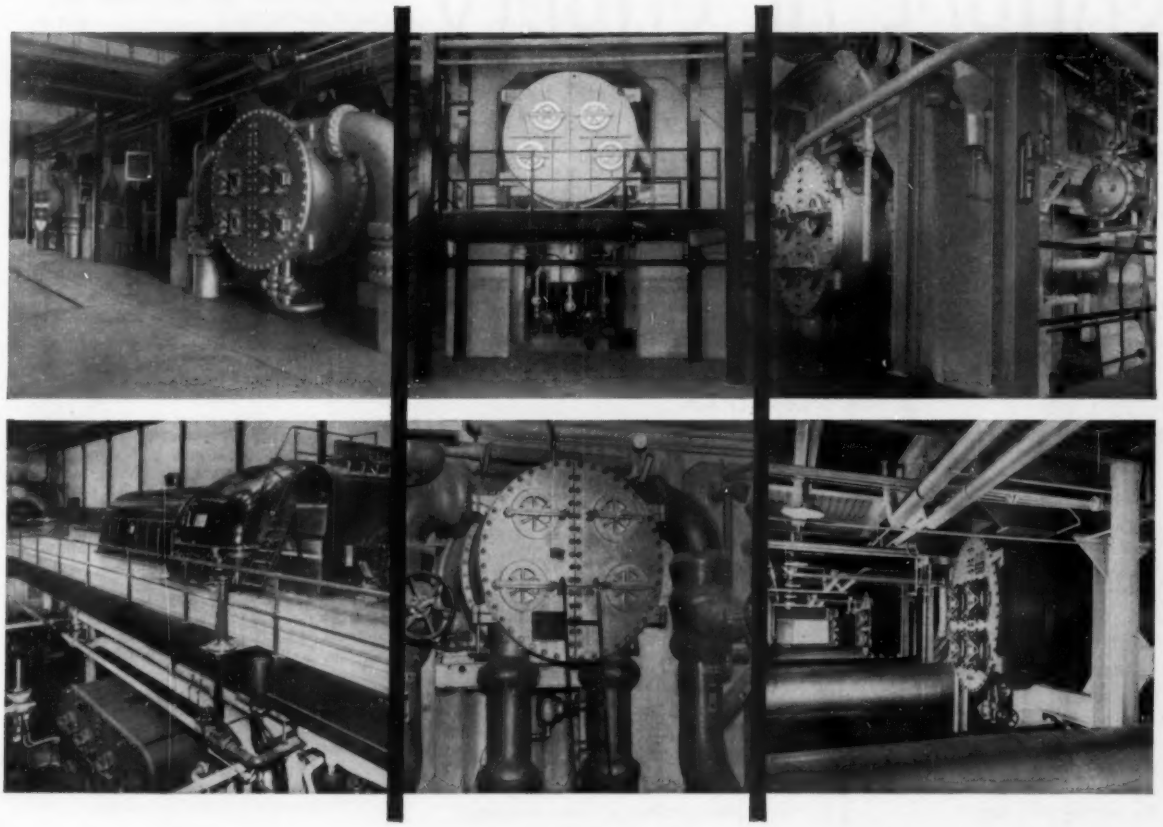

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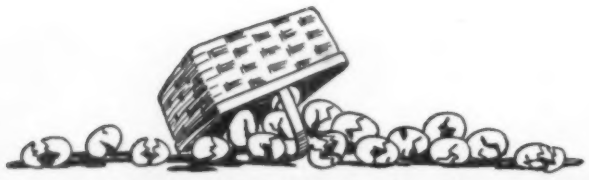

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of Continental automatic boiler's spinning gas technique — a method of obtaining maximum heat transfer with a simplified design. Shows cutaway view of boiler construction; illustrates hinged doors and method of injecting air through static, turbine-like vanes into burner. Boiler Engineering & Supply Co., Inc.

223 Self-Contained Boilers — Bulletin AD-144 reviews company's new CB boilers. Illustrations include installations, demonstrations. Engineering articles are featured covering such subjects as low noise level. Cleaver-Brooks Co.

224 Compact Generator — This bulletin describes a packaged water tube generator, company's Type DK, available in units for 8400 to 45,000 lb of steam per hour. Gives features, size and capacity data on these boilers which are designed to require less space than many water tube units. E. Keeler Co.

225 Improved Steam Generator — Bulletin 2000, 28 pp, explains advance design features that distinguish this manufacturer's generator from other unit steam generators. Describes and illustrates engineering differences of component features. Also shows how these components are constructed, assembled and tested. Another section gives data, and dimensions for the units which range from 20 to 6000 hp. Preferred Utilities Mfg. Corp.

Postage-free cards for ordering catalogs are on page 113. You may also use the cards to order literature mentioned in the ads.

226 Steam Generators — Illustrated Bulletin SB43, 20 pp, describes company's VL factory assembled generators combining 2-drum water-type boiler, integral water cooled furnace, brick work, insulation and steel casing. A large cutaway illustration shows design details, and gas travel. Erie City Iron Works.

227 Steam Generator — This manufacturer's new Type D steam generator, a packaged unit for pressure firing with gas, oils, or combination of fuels, is described in an 8-pp catalog. Gives complete data and dimensions on this water tube generator which is available in 17 sizes with capacities from 8000 to 40,000 lb of steam per hour. Fully illustrated, booklet explains economical steam production. Superior Combustion Industries, Inc.

BURNERS

228 Oil and Gas Burners — Bulletin OB-53, 28 pp, gives principles of selection and application of oil or gas burners, or a combination of both for standard and wide capacity range operation, together with air registers and fuel oil heating and pumping sets. Conversion table shows approximate relationships between quantity of oil burned, boiler capacity and air required for combustion. The Engineer Co.

229 Steam Atomizing Oil Burners — Sixteen-pp illustrated Bulletin 21 describes steam atomizing oil burners and auxiliary equipment for use with heavy oil or tar in boilers, stills, dryers and other furnaces, where steam or compressed air is available for atomizing the oil. Includes information on furnace design and construction. National Airoil Burner Co., Inc.

VALVES, TRAPS, PIPING AND ACCESSORIES

231 Check Valves — Twenty-pp Catalog 30 presents company's line of tilting-disc check valves made in iron, bronze and steel for working pressures to 3000 psi. Explains operating principles of tilting disc construction, discusses closing without slam, reduced loss of head, other advantages. Includes construction details, sizes. The Chapman Valve Mfg. Co.

232 Lubricated Plug Valves — Revised Catalog PV-2, 12 pp, presents steel and semi-steel valves designed to offer quick shut-off of erosive or corrosive fluids. Explains advantages of the lubricated tapered plug design of these valves and pictures single gland, screwed gland, and bolted gland types. Also shows accessories. The William Powell Co.

233 Blow-Off Valves — Bulletin B-426, 20 pp, on blow-off valves for boiler pressures up to 400 lb wsp, contains installation recommendations, construction information on Yarway seatless and double-tightening blow-off valves. Gives full ordering data. Yarnall-Waring Co.

234 Valve Chart — Form 194, 24 pp, is a valve comparison chart, listing valve figure numbers of 15 major manufacturers and the OIC equivalent valve figure numbers. Compares variety of valves in ferrous and non-ferrous materials, describes different valve lines. The Ohio Injector Co.

235 General Purpose Valves — Supplement No. 1 to Catalog F-9, 32-pp, offers complete information on company's series of general purpose drop forged steel valves, gate, globe and angle types, sizes ¼ through 2 in. Includes descriptions of each type along with drawings showing component parts. Dimensions and other specifications are tabulated, and a pressure-temperature ratings table is included Henry Vogt Machine Co.

236 Valve Charts — Now available to power engineers are three well-organized wall charts on valve types, selection and protection. "How to know valves" covers four main types of valves from the standpoints of their appearance, inside construction, service intended, operation and use. "How to select valves" discusses five major factors involved in the choice of a valve — fluid, temperature, pressure, size and function. "How to protect valves" — written in "do and don't" style covers 11 important points in valve installation, operation and maintenance. R-P & C Valve Div., American Chain & Cable Co., Inc.

237 Choosing the Right Valve — Presenting valve selection as a matter of matching the valve's service characteristics with service requirements of the job, this practical 20-pp booklet explains and illustrates basic design features of gate, globe and check valves. It tells, in non-technical language, how each of these valve types works, and where it is suited for use. Disc, stem connection, bonnet and bonnet-joint characteristics are discussed. Crane Co.

238 Industrial Valves — Condensed Catalog 105, 28-pp, contains data on valves for a wide variety of applications. Includes dimensions and illustrations describing non-return (stop-check) valves, globe and angle stop valves, pressure seal design, angle univalves and small size globe valves designed for chain or extension operation in vertical lines. Also in-

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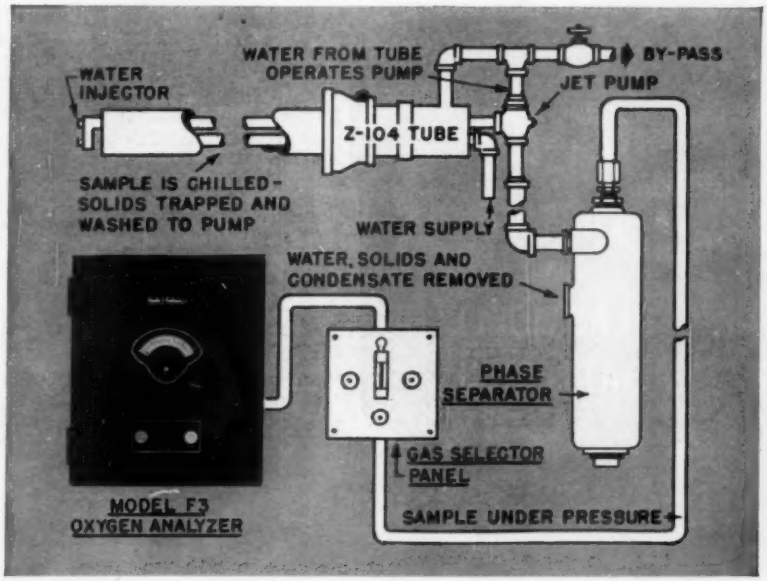

The diagram (above) shows a typical analysis system for boilers. The incoming sample gas is first chilled and washed . . . then passes through a Separator where the condensables and solids are removed. The resulting clean, dry sample gas flows under pressure to the Gas Selector Panel (for selecting "Zero," "Span" and "Sample" gases) . . . then into the Analyzer where the oxygen content is quickly measured. The Analyzer may be used with any standard recorder or controller.

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cluded is company's Mudwonder valve for abrasive fluids. Edward Valves, Inc.

239 Boiler Blow-Off Valves — Bulletin E-125, 24 pp, describes and illustrates the design and construction of company's quick-operating valves, angle valves, Y valves and duplex units specifically designed for boiler blow-off service. Includes dimensions, material specifications. Everlasting Valve Co.

240 Steel Gate Valves — Four types of Hancock general purpose steel gate valves for process and power piping systems are described in illustrated Bulletin 202 C, 12 pp. Material specifications, dimensions given, also service pressure ratings. Manning, Maxwell & Moore, Inc.

241 To Get at Those Valves — This little folder describes a sprocket rim with chain guide. The rim adjusts to fit all valve wheels. Babbitt Steam Specialty Co.

242 Regulating Valves — Bulletin 5305 describes double seated diaphragm regulating valves for use with control instruments, outlining special features of the valves, particularly the "flow line" contoured-body engineered for high capacity at low pressure drop. Leslie Co.

243 Steam Trap Book — Catalog J, 44 pp, serves as a manual of trapping practice. Includes a catalog section giving physical data and prices on cast semi-steel and forged steel inverted bucket steam traps, compound steam traps and ball float air and air relief traps; a handbook section explaining how to calculate condensate loads and select traps for all classes of equipment; a maintenance section explaining trap installation, trouble-shooting and repair. Armstrong Machine Works.

244 Steam Trap Solutions — Bulletin F. 151, 36 pp, is a newly revised edition of this company's well known booklet, "Solving Steam Trap Problems." Organized for easy reference, this illustrated booklet provides specifications and capacities of steam and float traps, air release valves, pipe line strainers. Tells how to calculate condensation loads and select traps for unit heaters, jacketed kettles, submerged surfaces. Gives tips on installing, servicing. The V. D. Anderson Co.

245 Asbestos-Cement Pipe — Manufacturing methods in producing asbestos-cement pipe for water systems are described in this 8-pp bulletin, which points out savings in installation time and outlines characteristic advantages once the pipe is in the ground. Recommended procedures for installing pipe and assembling Ring-Tite coupling, as well as table of sizes and fittings are included. Johns-Manville.

246 Stainless Steel Pipe Fittings — Bulletin S-3-55 describes company's 150 lb stainless steel pipe fittings for corrosive, high and low temperature service, including 90 deg elbows, tees, 45 deg elbows, crosses, couplings, reducers, pipe caps, unions, plugs and bushings. Presents dimensional specifications in sizes ⅛ to 2 in. in both screw end and socket welding types. Applications in chemical plants, refrigeration service, food and other process piping given. Watson-Stillman Fittings Div., H. K. Porter Co., Inc.

247 Stainless Tubing, Pipe — Technical Data Card 162A covers welding characteristics of austenitic and ferritic types of stainless steels, and briefly describes welding methods and techniques. Also included is a table indicating elec-

trodes, preheating and post welding heat treatments to be used in joining the stainless steels to each other and to carbon, carbon molybdenum and chromium molybdenum alloy steels by the arc welding method. Tubular Products Div., The Babcock & Wilcox Co.

248 Expansion Joint Guide — Catalog 153, 24-pp, a complete design guide for application and selection of expansion joints, is filled with engineering data necessary to solution of pipeline expansion problems. Includes a discussion of types of expansion joints available and types of pipeline motion solved by expansion joints. Includes a schematic piping layout illustrating expansion joint applications and principles, as well as full specifications. Flexonics Corp.

249 Expansion Joints — Rubber expansion joints for relieving strains and stresses in piping, absorbing vibration, and eliminating noise are the subject of 8-pp Form AD-137. General advantages of rubber expansion joints are presented, and spool-type, U-type and rectangular-type joints are described as to construction and intended services. Also provided is catalog sheet on all-Teflon joints and Teflon-lined rubber joints. The Garlock Packing Co.

REFRACTORIES

251 Refractory Notes — Included in Vol. XV of this company's Thermogram is an illustrated article on a method for decreasing hot topping costs in steel mills with minimum capital expenditure. Another story tells how bonded brick assemblies cut installation time in a coke plant. Refractory & Insulation Corp.

252 Refractory Concrete — Basic information on recommended practice for mixing and placing refractory concrete, used in the metal, power, ceramic, and petroleum refining industry as a material to withstand service temp to 2600 F or more, is presented in this 16-pp manual. Sections are devoted to special properties of refractory concrete, aggregates, refractory insulating concrete, and structural design. Universal Atlas Cement Co.

INSTRUMENTS AND CONTROLS

253 Metering and Control Equipment — Sixteen-pp Bulletin 18 is a comprehensive catalog offering information on company's meters, control equipment and engineering services. It is written for engineers in power plants, public utilities and process plants. Fifteen measured variables common to power and process operations form the index for selecting appropriate equipment. Bailey Meter Co.

254 Boiler Feed Control — Bulletin 1003, a 12-pp catalog on boiler feed regulators, is illustrated with large application photos and detailed schematic drawings and charts. Relay and direct operation are covered. Case studies of representative boiler loads are presented to show stability of the Flowmatics in controlling feedwater automatically. Copes-Vulcan Div., Blaw-Knox Co.

255 Instruments, Controls — Condensed Catalog 1537 offers brief application information on manufacturer's line of instruments. Fully illustrated, covers draft and pressure instruments, flow meters, liquid levels and pressure gages, CO meters, pneumatic transmitters, positioning operators, temperature instruments, boiler

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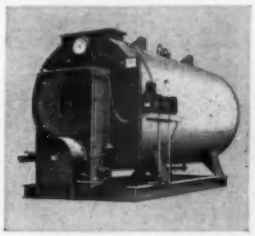

Front and right side view of one of four 400 hp Continental Automatic Boilers ready for shipment to four cement products processing plants.

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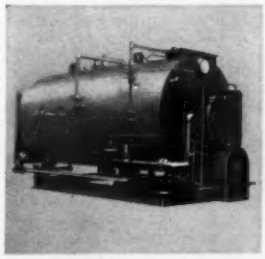
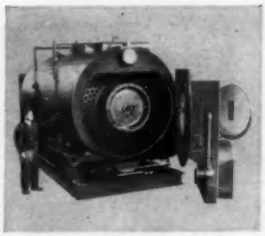


Front and left side view of same 400 hp unit — note simplicity of design.



View with front doors open showing gas burner assembly.

View with rear door open — showing furnace, return tubes and refractory-lined rear door.

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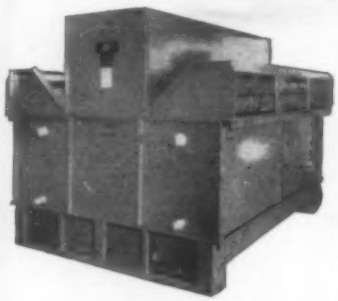

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feedwater controls, others. Includes references to detailed literature on each type of equipment. Republic Flow Meters Co.

256 Easy Reading Gage — An all-hydrostatic remote reading gage for boiler water and other liquid levels is described in Catalog 500, Section CO. Pictures improved visibility, other advantages offered by this gage, explains operation. The Reliance Gauge Column Co.

257 Resistance Temperature Detectors — In 8-pp Publication 3016D are described a line of remote temperature-sensitive elements for use in indicating, recording, controlling and monitoring equipment. Operation, application and construction details of the resistance temperature detectors are presented, along with specifications and ordering tips. Instrument Div., Thomas A. Edison, Inc.

258 Indicating Flow Meter — Bulletin 18-A, 22-pp, discusses advantages, construction and operation of company's Type H indicating flow meter. Presents technical data on the principles and theory of fluid measurement and discusses orifice type meters and orifice meter principles. Offers examples of flow rate calculations. Schematic drawings and diagrams, tabulated technical data and specifications are included. The Meriam Instrument Co.

259 D-C Amplifier — Twelve-pp Bulletin MSP 111.1 provides pictorial diagrams and descriptive information on company's PowrAmp Model P, an electronic low-voltage linear amplifier designed to increase the speed and accuracy of low level d-c voltage measurements. Discusses performance and construction features of the amplifier, and describes some applications. Specifications and ordering suggestions given. Hagan Corp.

260 Steam Calorimeter — This bulletin discusses an improved U-path calorimeter combining a throttling, separating and re-evaporating calorimeter in a single chamber. Explains construction and operation of unit. Ellison Draft Gage Co., Inc.

261 Sampling System — A newly developed system for continuous sampling and oxygen measurement of combustion processes is described in Bulletin 703. Points out advantages of system and diagrams component parts. Selection of sampling tube and gas selector units is discussed. Arnold O. Beckman, Inc.

262 For Feedwater Analysis — Bulletin 148BP contains a technical discussion of manufacturer's analyzers for determination of dissolved oxygen and hydrogen in feedwater. Discusses both O and H units as to function, ranges, accuracy. Cambridge Instrument Co., Inc.

263 Oil Leak Detection — Eight-pp illustrated Bulletin 80, on the Paraprobe oil leak detection system for steam-type fuel oil heaters gives a detailed explanation of the operation of the system. Provides installation diagrams, standard specifications, explains determination of condensate flow rate. Davis Engineering Corp.

264 Ideas on Push-Pull Controls — Included in this "Idea File" are answers to a power engineer's questions on the use of push-pull controls. A general information booklet discusses remote control applications, explains construction and operation of company's Tru-Lay controls. Separate bulletins are devoted to standard

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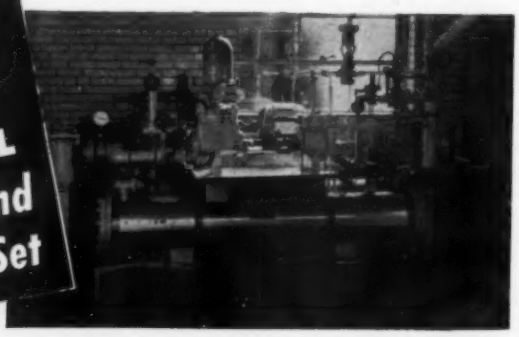

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ELECTRICAL EQUIPMENT

265 Motor-Generator Reference Book — Publication 51R7933 is a 50-pp booklet compiled to assist in the selection of motive power to handle most industrial applications. Neither textbook nor ordering catalog, this book provides a brief outline of the various types of motors, generators and motor-generator sets, telling their applications and operating requirements. Booklet is generously illustrated and includes performance data, ratings, as well as detailed information on speed control. Allis-Chalmers Mfg. Co.

266 Motor Buying Guide — Bulletin GEC-1026, 28-pp, features company's standard a-c fractional and integral horsepower motors in most general use. Included are general- and definite-purpose fhp motors, and fhp gear motors. A section on selection of integral horsepower motors covers horsepower requirements, enclosures, starting current limitations, speeds, motor types, and selection of fuses and circuit breakers. Descriptions and specifications include single-phase, polyphase, totally enclosed fan cooled, and gear-type integral horsepower motors. Ratings, book prices, dimensions, frame numbers are included. General Electric Co.

267 Insulation Temperature-Resistance — Technical Publication 21T4, 16 pp, is an article on temperature-resistance characteristics of electrical insulation. Complete with tables and graphs, gives general information on variations in temperature characteristics, composite nature of electrical insulation, and practicability of temperature compensation. Other chapters deal with determining insulation constants for temperature correction factors, and a practical method of obtaining insulation temperature is outlined and described. James G. Biddle Co.

268 Fuses for All Uses — This revised edition of manufacturer's Complete Line Folder 3 includes illustrations and descriptions of fuses for every purpose. Features dual-element cartridge fuses for time-lag in protection against overloads, and delay renewable fuses and renewal links. Economy Fuse & Mfg. Co.

269 High-Power Batteries — Bulletin CP-538/55 covers company's line of Hi-Power batteries for use in the control, switchgear, emergency lighting and auxiliary power fields. Includes data on battery ratings and capacities, details of design and construction, dimensions, weights and types of containers. C & D Batteries, Inc.

270 Cable Compound — Test Results and service records on an improved butyl rubber compound for high-voltage cables are announced in 12-pp Bulletin EB-27. Covers resistance to ozone, operating temperature, high-voltage, dielectric strength, aging, insulation resistance, mechanical moisture absorption, electrical moisture absorption, capacity and power factor. Diagrams, charts and tables amplify text. Anaconda Wire & Cable Co.

TUBING AND ACCESSORIES

271 Rotary Tube Cleaners — Bulletin R-105 presents air and water driven rotary tube cleaners and cleaner accesso-

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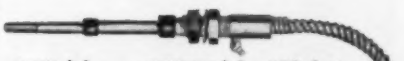

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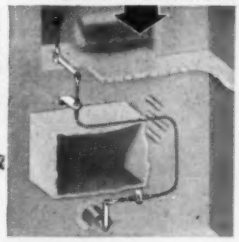

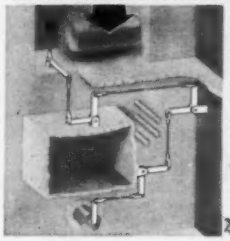

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The six bulletins and booklets in the DATA FILE will answer all your further questions. Write for your copy.

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ries. Illustrates several models and heads. Roto Div., Elliott Co.

272 Nickel Pipe and Tubes — Bulletin T-17 is a 28-pp technical bulletin on the fabrication and design of nickel and high nickel alloy pipe and tubing, illustrated throughout by drawings and photos. Presents tables on mechanical and physical properties, ASME code requirements, recommended welding procedures. The International Nickel Co., Inc.

273 Life Extension for Condenser Tubes — The 32-pp current edition of this booklet reports on research into the causes of corrosion and means of combating them, as well as the choice of condenser tube materials. Points out that Admiralty metal, long a standard for power plant condenser tubes, works satisfactorily in most installations, but other alloys may be necessary in some circumstances. Revere Copper and Brass, Inc.

You'll save time in ordering bulletins by using the Reader Service Cards on page 113. Of course we honor letterhead requests—but it takes us somewhat longer to handle them.

274 Tube Cleaners — Catalog 76-A provides 48 pp of information on manufacturer's line of tube cleaners. Following equipment selection and operating hints, this practical catalog describes and pictures cutter heads and drill heads, brushes, and motors, giving sizes, application information. Thomas C. Wilson, Inc.

OTHER EQUIPMENT

275 Steam Accumulator — How the steam supply and demand can be balanced by means of company's steam accumulator is told in Bulletin RA-52-8. Stresses reduced boiler capacity required and increased boiler efficiency afforded by use of the accumulator, other advantages. Discusses operating principle, tells how to figure capacity. Foster Wheeler Corp.

276 Heat Transfer Apparatus — Condensed Bulletin HT-1 highlights representative products in company's line of heat transfer equipment. Includes oil heaters and coolers, strainers, evaporators, heat exchangers, radiafin air coolers, tubes, pipes, and coils. Cross-section views of typical units are shown, brief descriptions given. Schutte and Koerting Co.

277 Corrosion, Abrasion Control — Modern practices and products for the positive protection of metal equipment from the effects of corrosion and abrasion are described in this 16-pp bulletin. Covers factory and field application of rubber or synthetic linings to metal parts or products, and maintenance coatings available for application by plant personnel. Goodall Rubber Co.

278 Preheating Combustion Air — This well-illustrated 36-pp booklet explains fuel savings and increased performance made possible by using waste heat in flue gases to preheat incoming combustion air. Also covers increased boiler output, ability to use lower grade fuels, other advantages afforded. Booklet contrasts regenerative with recuperative preheaters; explains operating principle and structural

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details of the Ljungstrom air preheater. Applications for other than power boilers are also covered. Air Preheater Corp.

279 Steam Turbines — The advantages of company's solid wheel turbines, axial flow turbines, single stage and multistage, are outlined in illustrated Bulletin S-140. Describes various models in their line and includes application photos. The Terry Steam Turbine Co.

280 Technical Refrigeration — Twelve-pp Bulletin 754 covers a complete line of environmental testing and processing equipment. Provides illustrations and specifications on recently redesigned altitude, humidity, low temperature and prefabricated test chambers as well as specialized testing equipment. Includes helpful engineering data. Bowser, Inc.

281 Packings and Gaskets — Catalog P-100C, 32 pp, covers 95 most popular packings and gaskets in company's line, furnishing details of construction, service recommendations and size information. Includes charts showing applications. Packing Div., Raybestos-Manhattan, Inc.

282 Petroleum Pitch — This illustrated article on petroleum pitch as a boiler fuel stresses its low cost, other advantages. Explains combustion of pitch; discusses unloading method, burning, storage, fuel oil treatment, also precautions in handling hot pitch. Kor Corp.

283 For Burning Refuse Fuel — This 8-pp bulletin describes refuse fuel burning equipment, including a pneumatic refuse fuel distributor which spreads refuse fuels such as bark, wood chips, and bagasse uniformly over the grate surface. Discusses construction features of various components, the selection of grates, as well as pertinent design and engineering features. Riley Stoker Corp.

284 After Cooler — Bulletin 130, 8-pp, explains the functions of company's Aero after cooler in removing moisture from compressed air and gas. The apparatus is described and illustrated with diagrams and photos. Included also are diagrams and illustrations of applications in liquefaction systems. Niagara Blower Co.

285 Fluid Drives — Bulletins 9419 and 9519 are an illustrated catalog and selection guide on company's new Type VS Class 2 Gyrol fluid drives. Catalog discusses advantages and applications of the drives, covering speed control, power savings, simplified installation, etc. A sectional view shows construction and principle of operation. Dimensions for six sizes of drives are provided. Selection guide consists of tables indicating proper drive to use. American Blower Corp.

286 Process Heating Equipment — Bulletin DV presents process heating equipment for use with Dowtherm A and E, Para-Cymene, Arclor 1248 and heat transfer oil. Described and illustrated are vaporizers (both packaged and field erected units), electrically-heated vaporizers and forced circulation liquid heating and cooling units. Union Iron Works.

287 Speed Reducers — Design and operation advantages of company's line of Torque-Arm speed reducers are outlined in 28-pp Bulletin A-637. Includes selection tables for double and single reduction units, bore dimensions and bushings, data on overload releases, flange mounted speed reducers, and recommended V-belt drives. Dodge Mfg. Corp.

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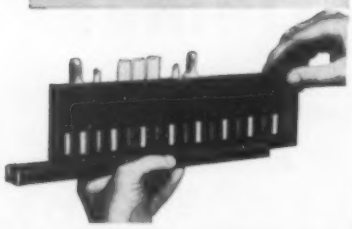

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EQUIPMENT NEWS

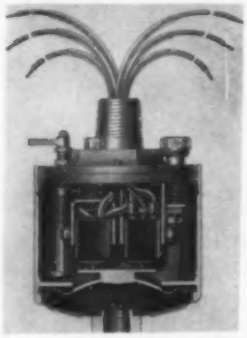
continued from page 54

33—INSTRUMENT TRANSFORMER for indoor service

The JCS-0 is a 600-v window-type butyl-molded instrument transformer for switchboard and switchgear applications. Designed for indoor service, it is available in standard ASA current ratings from 200:5 to 4000:5 amp. Frequency is 50/60 cycles and thermal rating is 100 per cent of rated current with 55 C ambient and 133 per cent of rated current with 30 C ambient. Two window diameters are provided: 4½ in. for the 200:5 to 600:5 amp ratings and 5⅜ in. for the 800:5 to 4000:5 amp ratings. The molded butyl serves as both insulation and case, achieving the light weight of 28 lb. The unit is said to be lighter, more accurate, more rugged, and less expensive than its predecessor the JS-2. General Electric Co.

34—SWITCH signals pressure rise or fall to danger zone

The Model 432 Meletron Pressure Switch may be used to signal when pressure rises or fails to danger zone and then to shut down the system if pressure continues to rise or fall to a predetermined safety limit. Manual reset is so arranged that system cannot be reactivated until pressure has been returned to a safe level. Each switching element in the unit can be electrically independent of the other, (one a-c, the other d-c if necessary), or two external leads can be supplied to control a single circuit between maximum and minimum pressures. Switch comes in three classes of proof pressures: 6, 30 and 120 psi, with an adjustable range from 0.05 to 100 psi. List price is about $28. Pressure Switch Div., Barksdale Valves.



35—ALLOY FITTINGS for materials handling piping

One-piece wear-back pipe fittings are described as having features which reduce friction loss and specific troubles resulting from abrasive wear. Although designed primarily for systems where materials are conveyed hydraulically, they can also be used for pneumatic systems. For the latter, experience is reported to show that the fittings have long wearing qualities with fine ma-

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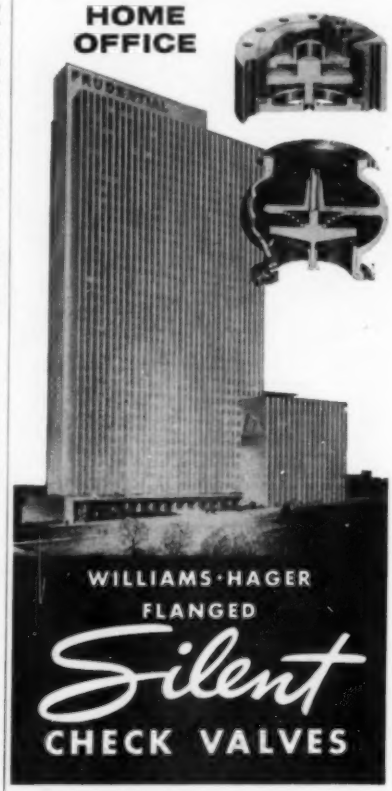

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Rockefeller Center Buildings, New York, N. Y.
Standard Oil Building, Chicago, Ill.

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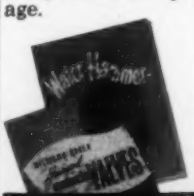

Write for Bulletins:
No. 654 on the Valves
No. 851 on Cause, Effect and Control of Water Hammer

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terials, such as boiler fly ash. The line includes elbows with turn angles of 90-, 45- and 22½-deg to suit the piping layout. Long turn radii serve to reduce friction loss. Also in the line is an integral lateral fitting with a 45-deg angle connection for the juncture of two pipe lines. Fitting sizes range from 4 to 12 in.

Fittings are usually supplied with plain ends for connection by sleeve coupling to company's Ashcolite piping, which has plain ends. This method of coupling reduces installation time and permits rotation of fittings without alignment of bolt holes. Adaptors are available, however to permit connection to flange assemblies when required. The Allen-Sherman-Hoff Co.

Reader Service Cards on pages 113–114 make it easy to get further information on any of these products. Just circle the item numbers of the products you want to know more about.

36—CAPACITOR, carrier current coupling type, rated 46 to 345 kv

The Type PC-3 is announced as a carrier current coupling capacitor having a high capacitance. Rated from 46 to 345 kv, the unit features mechanical strength and ease of tuning, it is reported, and it provides a low-loss path for broad-band coupling of carrier signals to high voltage transmission lines. The capacitor is also available with a Class A potential device to provide a source of low voltage power for relaying functions. Westinghouse Electric Corp.

37—AIR DIFFUSING GRILLE for use under large windows

Uni-Flo Model ST, for continuous line installation, is designed to prevent cold convection currents. It is suggested for heating, ventilating and air conditioning in buildings where large glass areas are used. Barber-Colman Co.

38—URANIUM DETECTOR SET is inexpensive, easy to use

For power engineers planning some week-end prospecting, the Urani-Tector Uranium Detector Kit contains necessary materials, is easily used, and claimed effective. Invented by two University of Wyoming scientists, the detector uses energy from the sun. Included in the kit — which costs less than $9.00 — are the fold-up pocket-size detector, apparatus for appraising uranium, instructions, and four typical uranium ores. Or you can buy the detector itself (with one ore sample) for less than $4.00. CMG Industries.

39—CONDUIT BUSHINGS withstand higher temperatures

Poly Ester Glass Insulating (Pegi) Conduit Bushings are announced as available in all conduit sizes and at no extra cost over most phenolic bushings. It is said that these glass reinforced bushings have greater strength; can withstand higher temperatures; show a dielectric of 390-v per mil; are self extinguishing after being exposed to flame; and show practically no water absorption. The Adalet Mfg. Co.

COAL STORAGE MANUAL . . . Reprints Available

REPRINT copies of POWER ENGINEERING 24-page Coal Storage Manual, which appeared first as a Special Feature in the March issue, are now available in limited quantities to interested readers.

Because the demand for these reprints exceeded expectations, and additional supply has been procured. Up to 2 copies will still be sent free of charge to any reader who requests them by addressing the Editor, 110 S. Dearborn St., Chicago 3, Ill.

Additional copies up to 12, $1.00 each; over 12, but less than 100, 20% discount; more than 100, write for prices.

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FIG. 29 Cylinder with Impeller

FIG. 17-28 Cylinder

FIG. 215 Flanged

FIG. E-57 Double Window

FIG. 212 Visibility Welding Neck or Screw

FIG. E-811 Flapper

FIG. E-1810 Rotating Wheel Type

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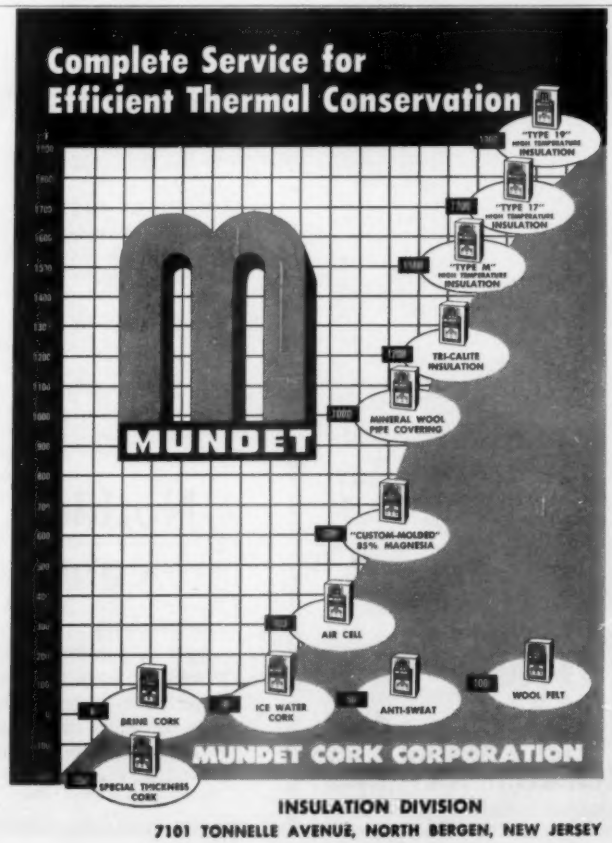

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NEW ENGINEERING BOOKS

Hydraulic Institute Pipe Friction Manual. Size 8½ by 11 in., 87 pages; paper. Published by Hydraulic Institute, 122 East 42nd St., New York 17, N. Y. Price $1.75.

This Pipe Friction Manual has been published by the Hydraulic Institute as the result of an investigation undertaken to revise pipe friction data contained in an earlier edition entitled "Tentative Standards of Hydraulic Institute — Pipe Friction."

The material contained in this booklet is based on the latest information available, and the references from which the information was obtained are listed at the end of the book.

The tables include friction losses for water in various types and sizes of iron and steel piping; resistance coefficients for standard valves fittings, bends, etc.; friction loss modulus for various pipes; friction factors; relative roughness factors; kinematic viscosity and Reynolds Number chart; typical shear rate curves; petroleum temp gravity relations; petroleum temp volume relations; viscosity index; viscosity blending chart; viscosity conversion table; viscosity of common liquids; properties of water at various temperatures; properties of steel and wrought iron pipe, etc.

★ ★ ★

Professional Engineering Registration Laws, compiled by Alfred L. McCawley. Size 6¼ in. by 9¼; 614 pages; cloth. Published by Trustee Publication Fund, Jefferson City, Mo. Price $8.75.

This book is a compendium containing the professional engineering registration laws for each one of the 48 states, together with Alaska, Hawaii, Puerto Rico, and the District of Columbia.

State by state the author has presented the exact legal requirements that must be met for professional practice. Such things as: legislative authority for the law; educational requirements; number of years experience; examinations; public works projects; fees and bonds; filing of maps; engineer-in-training laws; certificate applications, and temporary permits.

The book is planned to be the foundation volume of Professional Engineering Registration Laws, to be revised at intervals of ten years or less, as may be found necessary. It is to be kept up to date between revisions by cumulative supplements.

This edition covers professional engineering registration laws beginning with 1907 to April 1, 1954.

★ ★ ★

Flight Handbook by Maurice A. Smith — fifth edition, 280 pages — 5¾ by 8¾ in.; cloth. Published by the Philosophical Library, 15 E. 40th St., New York 16, N. Y., 1955. Price $6.00.

While this book has nothing to do with conventional power plants, power engineers will, nevertheless, be interested in the complexity and high capacity per unit weight of the modern aircraft engine so ably described in this book. It gives a great many mechanical details of airplane construction and any engineer will find this book of interest.

★ ★ ★

Nuclear Reactors for Industry and Universities. Edited by Ernest H. Wakefield; first edition, 93 pages, 5½ by 8¼ in.; cloth. Published by Instruments Publishing Company, 845 Ridge Ave., Pittsburgh, Penna., 1954. Price $2.00.

This book is devoted essentially to a discussion and descriptions of research reactors; the type of reactor now available for use in universities and in research laboratories of private companies.

Until recently, nuclear reactors were operated only by the Atomic Energy Commission, but now small research reactors are ready for use by universities and other privately owned laboratories. Any large university or private industrial organization may possess one. Indeed, all progressive technical universities and research-minded industries may find it necessary to operate a research reactor not only for keeping abreast of the field of nucleonics or for teaching the nucleonic theories to engineers and students, but also to maintain any competitive advantages, which they now enjoy over other

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universities and industries. For this reason, the publication of this first book on nuclear reactors for research purposes at universities and private research laboratories will be very welcome.

The book was written by eight authors, all eminent authorities in the field. It covers the following basic subjects: nuclear reactor types, availability and selection, radio activity measurement, radiation protection, reactor control, instruments for experiments, cost study, and legal aspects. The cost study is detailed and includes building and supplementary laboratory and research activities. The book should be of undoubted value in assisting any university or private industrial laboratory organization to choose a reactor type to estimate its cost, to understand its implications to the operator, as well as to the nation.

★ ★ ★

Front Line Cost Administration, by W. C. Cooling; 260 pages; size 5½" X 8¼", cloth cover. Published by Book Division, Conover-Mast Publications, Inc., 205 E. 42nd St., New York 17, N. Y. Price $5.00.

Foremen and supervisors are the front-line administrators of all management policies which control manufacturing costs, to quote the author. This statement alone gives a good idea of the content of this book and why it was written. While most of the cases considered pertain to the administration of manufacturing operations, the power engineer can learn much of work simplification, incentives, job evaluation, maintenance, reports, training, and the many other factors which affect the smooth and trouble-free operation of his plant. The book has another effect; one cannot help wondering if the typical foreman and many of the supervisors are qualified to handle the legitimate duties outlined by the book.

All the factors discussed in this book are aimed at one target, and that is the reduction of the cost of each product or service provided. While it is no panacea, we believe that the book would help foremen and supervisors keep their jobs in proper perspective. Exposing power plant foremen and supervisors to some of the excellent work-saving systems and devices contrived by manufacturing industries certainly could do no harm and quite possibly could lead to more efficient use of the power plant crew and facilities.

★ ★ ★

Heating Ventilating Air Conditioning Guide 1955, 33rd edition. Size 6 by 9 in., cloth. Technical section is 1160 pages; equipment section includes technical data concerning the products of 328 manufacturers. Published by the American Society of Heating and Air-Conditioning Engineers, 62 Worth St., New York 13, N. Y. Price $12.00.

The many revisions and expansions of the 33rd Edition are the result of research by the Society and others, changes in codes and standards, new methods in product design, and improved engineering practices. However, despite the many improvements, the

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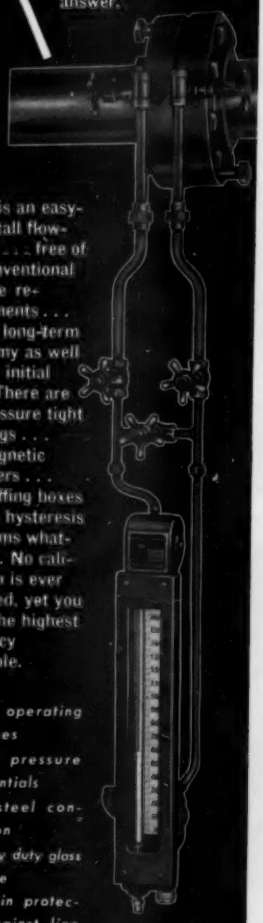

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Engineering Books

continued from page 129

appearance and arrangement of the chapters is the same, and the 58 chapters are grouped as I — Fundamentals, II — Human Reactions, III — Heating and Cooling Loads, IV — Combustion and Consumption of Fuels, V — Systems and Equipment, VI — Special Systems, and VII — Instruments and Codes. Also retained are the edge indexes in both the Technical and Catalog Data Sections, and classified subject and product indexes; and the 24 X 32 in. ASHAE Psychrometric Chart is still included.

The many changes include several rewritten chapters, a new chapter on schoolhouse heating and ventilating, new information on heating systems using high temperature hot water, and reorganized design information on thermal conductivities and conductances for pipe insulation and building materials. In addition, there are major revisions and changes in many of the chapters.

★ ★ ★

Servomechanisms and Regulating System Design, Volume 2, by Harold Chestnut and Robert W. Mayer; 385 pages; size 6¼" X 9¼", cloth bound. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price $8.50.

There is no point in arguing any more about whether automation is good or bad. It is with us, and it will stay with us. The problems involved are highly technical as is indicated by a study of this book. At that, they may be less complicated than the problems of human relations in the non-automated plant.

Be that as it may, servomechanisms become extremely complicated as the duties given them are increased and as the speed and accuracy of response become more critical. This book is devoted to the design of fast and accurate servomechanisms, and the analysis of the system requirements and the servomechanism response. It is not a book normally found on an operating engineer's shelf, because few operating engineers design or actually conduct analysis of their own systems.

If you are concerned with the design of network controls, plant equipment controls, or with the utilization of outputs from the new calculators, you will find the book of value. It is comprehensive and sufficiently detailed to lead you through the actual design of modern control systems.

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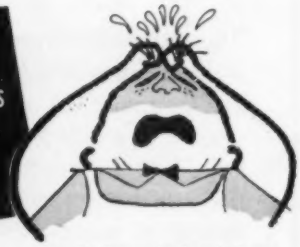
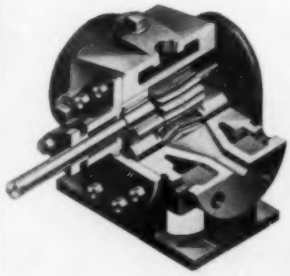
DON'T GIVE UP when viscous liquids cause pumping problems . . .





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National Electrical Code Handbook, Eighth Edition based on the 1953 edition. Revised by National Fire Protection Associations. Size 5¾ by 8¼ in., 642 pages; cloth. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York, N. Y. Price $7.50.

The many former editions of this book prepared by Arthur L. Abbott have kept electrical workers reliably informed on the meaning and intent of the various rules of the National Electrical Code. Now thoroughly revised by Charles L. Smith, Electrical Field Engineer of the National Fire Protection Association, the present volume for the first time has been prepared by an official of the organization originating the Code.

The handbook explains the NEC rules in brief, easy-to-understand language. It gives the general plan, scope, and intent of Code requirements, and discusses them in simple fashion to aid electrical contractors, electricians and others in making and planning electrical installations that are in conformity with the National Electrical Code.

The present edition contains all the changes reflected in the 1953 Edition of the Code. In addition, the format of the book has been changed to provide greater ease in use — the various sections of the book are numbered exactly as the Code. The actual language of the Code is given; then in a contrasting typeface, the meaning and intent of the particular rule is clarified in the author's own words.

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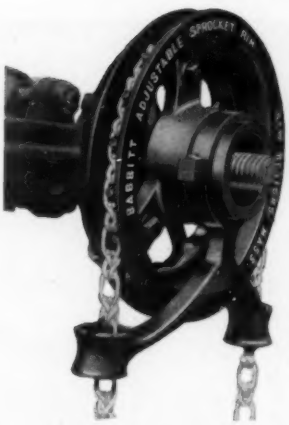

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Adjustable
SPROCKET RIM
with Chain Guide

ANY VALVE is readily accessible *from the floor* with low-cost Babbitt Sprocket Rim. Now re-designed for—

- **Greater strength**
- **Easier, quicker, more solid assembly**

Simplifies pipe layouts, prevents accidents, fits all valve wheels. Your supplier carries complete stocks. Call him — or write for folder and prices.

Babbitt STEAM SPECIALTY CO.

4 BABBITT SQUARE, NEW BEDFORD, MASSACHUSETTS, U. S. A.

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Gives more service and better results at less cost than any other product of its kind

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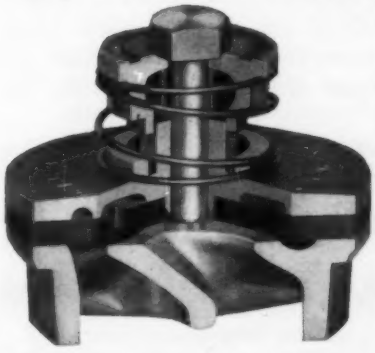
SIMS INCLINED PORT ROTATING PUMP VALVES



Guaranteed to:

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2. **INCREASE Pump Capacity.**
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4. **WORK Efficiently in Light or Heavy Liquids.**

Sims Valves are available for all reciprocating pumps from stock.

Write for New Catalog PE-5

Sims PUMP VALVE CO., INC.

1314 Park Avenue **Hoboken, N. J.**

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ESTABLISHED 1885

LEADING IN LIQUID-HANDLING EQUIPMENT FOR INDUSTRY

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Bowser meters record and control fuel and industrial liquids for accurate accounting.

2 FILTERING

Bowser-filtered fuel protects costly equipment. Replaceable cartridges deliver clean, polished filtrate at low cost. Used for fuel and process liquids.

Wherever liquids are handled for power, process or production, Bowser engineers work with plant engineers to improve efficiency.

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Bowser systems keep lube oils dry and clean. Stop bearing failures. Oil lasts longer. Power equipment is protected.

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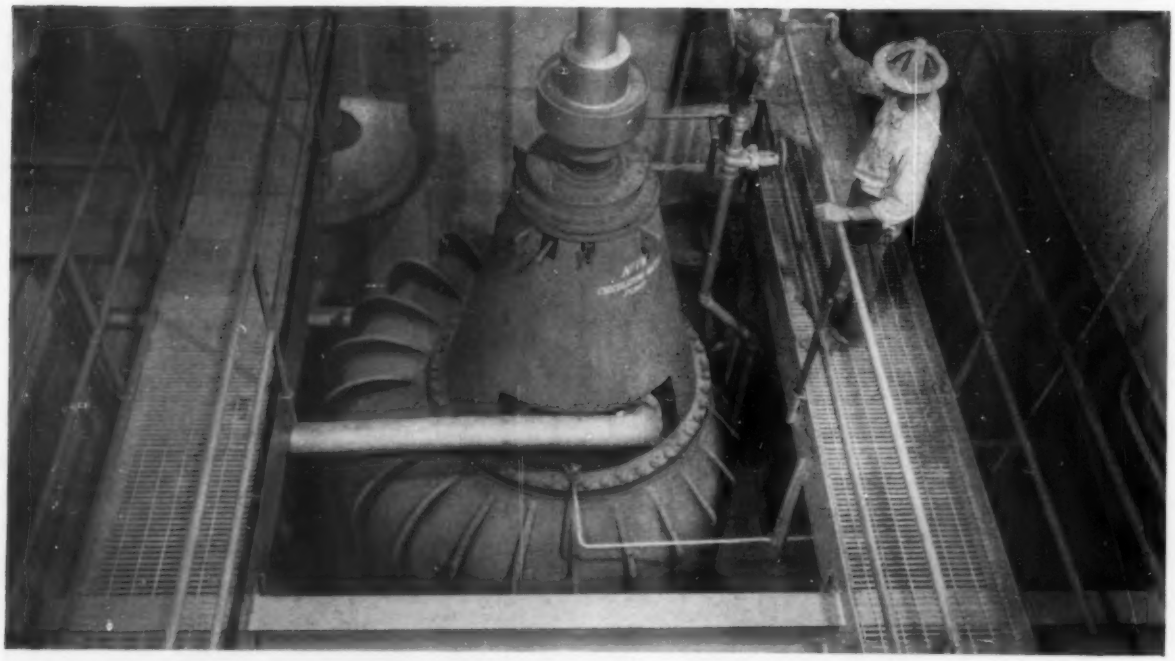
Allis-Chalmers

PUMPS Meet Power Plant Requirements



Heavy-Duty Construction Helps Assure Service Continuity

At Clifty Creek Plant of the Indiana-Kentucky Electric Corporation, the use of 12 Allis-Chalmers vertical condenser circulating pumps for dry pit installation helps to assure service continuity and reduced maintenance.

Rigid whip-free shaft, protected oil-lubricated bearings, and special new-type rib construction that makes casing stronger and saves space — these are some of the features that make A-C circulating pumps popular throughout the power industry.

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You get **MORE**... when you specify ALLIS-CHALMERS

Design and construction features like these assure dependable, day-after-day operation — better performance and low operating costs for you.

Benefit from Allis-Chalmers experience in building pumps for every industry. Industry-trained engineers are at your service to aid in selecting the right pump for your application. And, you can get the complete unit — pump, motor, control — from Allis-Chalmers.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4973

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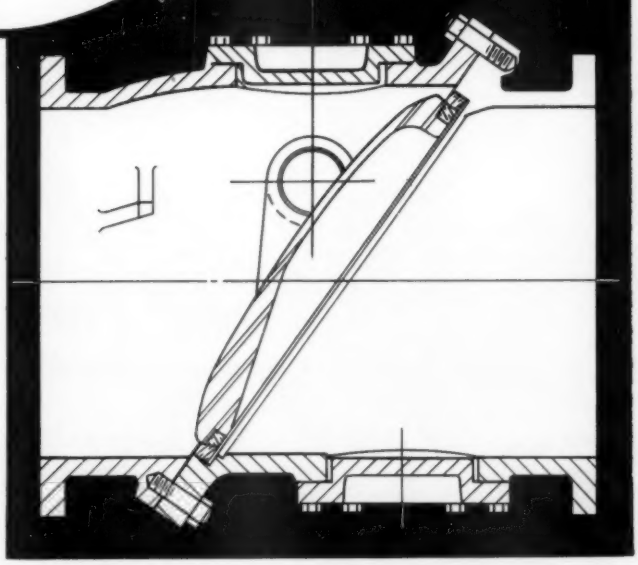
CHAPMAN TILTING DISC CHECK VALVE

the Valve with the Right Idea!



Here is a cross section of top check valve performance at lowest cost. It's the idea in back of Chapman's Tilting Disc Check Valve . . . the valve that's designed to go with the flow.

When the flow is on, specially designed "airfoil" disc balances perfectly in open position. Fluid holds it tightly against stops. There's no vibration . . . no flutter. It's quiet. And note the design. Ample room is allowed around disc to assure low flow resistance.

When the flow is reversed, disc drops surely, quietly, *tightly* on special beveled seat. There's no banging, no slamming, no scraping or wearing of disc and seat faces, no damage to piping joints or the valve itself. It's as simple as that. It's as *sound* as that. It has the right idea.

Complete information on these rugged, quiet, long life check valves is highlighted in our Catalog 30-A. Whether you want iron or steel construction . . . whether you handle fluids or gases under a wide range of pressures . . . this catalog gives you all the facts. Send for your up-to-date copy, today.

The CHAPMAN VALVE Mfg. CO.

INDIAN ORCHARD, MASS.

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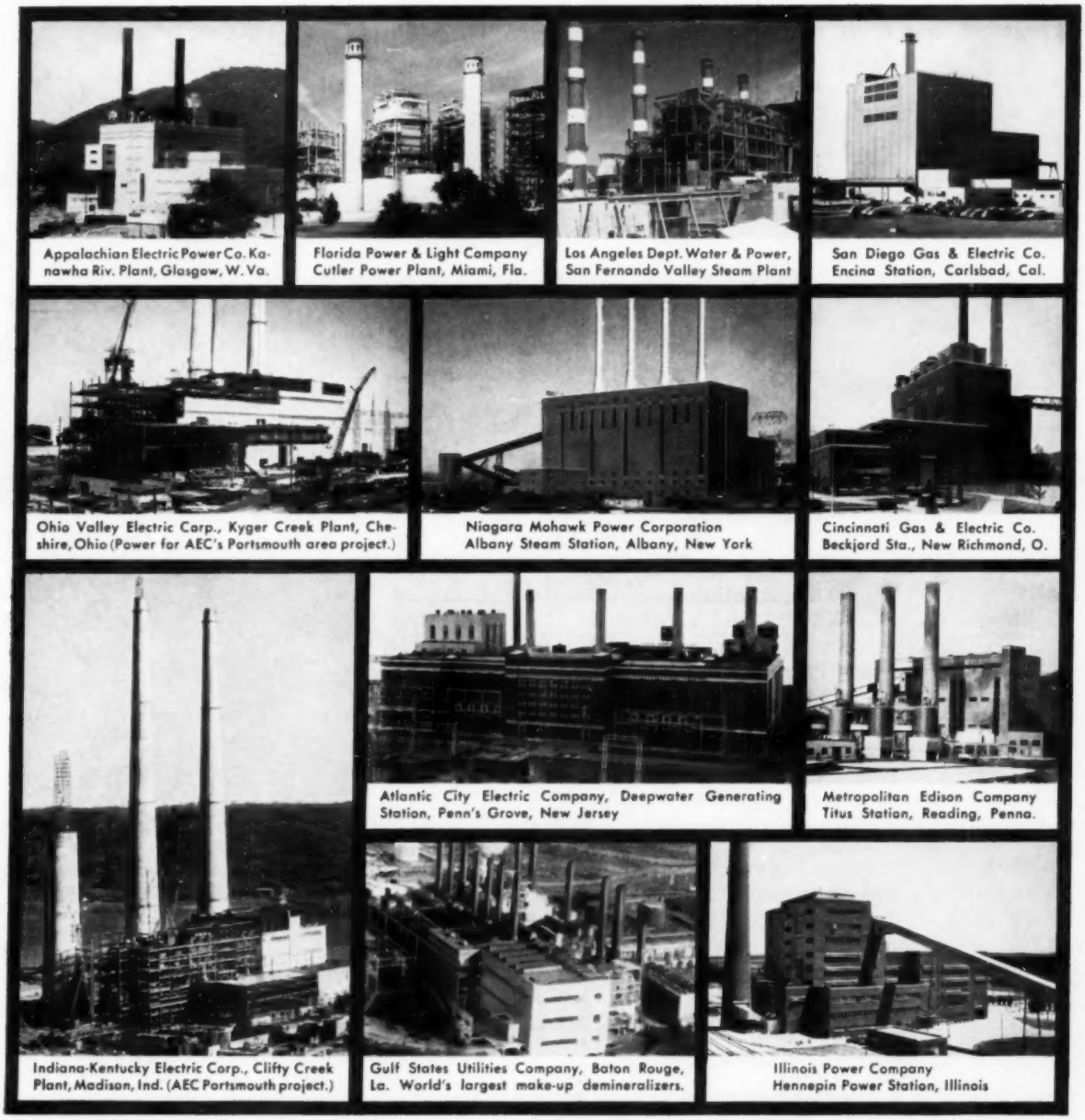

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